ELECTRICAL REVIEW

FRIDAY
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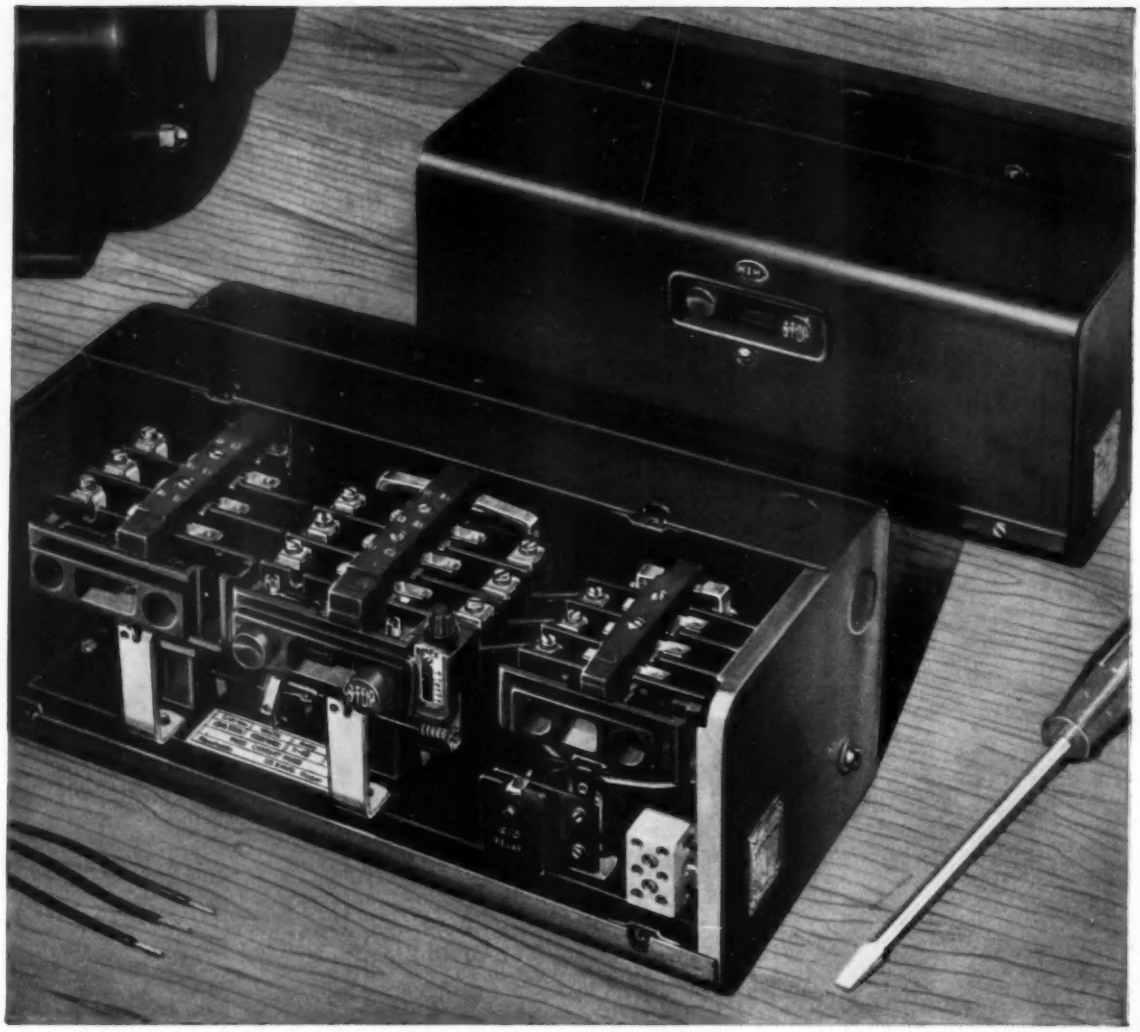

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ELECTRICAL REVIEW

15 May 1959 Vol. 164 No. 20 Established 1872

Improving Operational Efficiency

THE opening of Chapelcross nuclear power station earlier this month placed this country well ahead of the rest of the world in the commercial exploitation of nuclear power. This position is likely to be well maintained in view of the excellent progress which is being made with the comprehensive programme of nuclear power station construction now being carried out for the Central Electricity Generating Board and the South of Scotland Electricity Board. All this activity in the nuclear field, however, does not mean that the development of conventional coal-fired plant is quiescent. Far from it: both the electricity supply authorities and the manufacturers of generating plant are pursuing vigorous programmes of research and development in the endeavour to increase thermal efficiency of operation. This is very necessary because, despite the magnitude of the nuclear power programme, the major part of this country's electrical energy requirements will continue to be met by coal or oil fired generating plant for many years.

At the beginning of this year the total generating capacity installed in the Central Electricity Generating Board's power stations was over 25,000 MW but the demand for power is such that by 1965 the figure is planned to be about 40,000 MW. As we need not only more power but more efficiently generated or cheaper power, steam pressures and temperatures are being raised and larger individual generating units are coming into use. Within the last few months units of 120 MW capacity have been commissioned and constructional work is in progress on several units of 200 MW capacity; even larger sets are planned for Blyth "B" where two 275 MW units will be installed and for Thorpe Marsh with two 550 MW units. Recently the C.E.G.B. announced its intention to build Drakelow "C" power station. This will have a capacity of about 1,500 MW, probably in four 350 MW units.

All the stations mentioned operate with advanced steam conditions and one of the reasons for the large size of the units is to secure the utmost benefit from the resulting improvement in overall thermal efficiency. In fact, the largest unit possible consistent with load demands nearly always has the lowest capital cost per kW. With large turbines, however, the problem of excessive exhaust wetness arises when advanced steam conditions are employed. This is overcome by employing the reheat cycle whereby, after the steam has expanded through the high pressure turbine, it is again

heated to a temperature about the same as that at the stop valve. This results not only in a reduction in exhaust wetness but an improvement in the thermal efficiency of the whole cycle, mainly because the average temperature of the total heat input is raised. The reduced wetness also improves the efficiency of the turbine itself and reduces its steam consumption. A good example of a modern reheat installation is that at Kincardine generating station which we describe in this issue.

PLANT GROWTH

The very large generating sets which have been the outcome of the constant striving after greater efficiency have caused a profound change in the heavy electrical and allied plant industry. In the days of the 30 and 60 MW sets the production of plant could be shared by a number of firms and thus be well distributed geographically.

Now, the large concerns capable of making the outsized sets must be prepared to take on contracts for them even if the orders do not immediately materialise. Thus a great deal of capital expenditure has had to be undertaken by the plant manufacturers, as has been pointed out by Mr. W. Lionel Fraser in his annual statement as chairman of Babcock & Wilcox, Ltd. This is not to say that the day of the "smaller" sets is over. There are still many parts of the world in which they are wanted, and this again lays emphasis upon the importance of export trade to the electrical industry as a means of fully occupying its productive capacity.

FUEL POLICY

After barely satisfying the home demand for many years, and having to curtail exports, the British coal-mining industry is now endeavouring to restrict production in the face of mounting stocks. The industry's position is largely of its own making. In the immediate post-war period it was constantly saying that saleable coal was becoming increasingly difficult to mine and would be exhausted within a comparatively short time. This had the effect of scaring users into adopting oil as a substitute for coal.

Now the mining industry wishes to put the machine into reverse: to encourage the use of coal and retard the advance of oil. Some would also like to see the nuclear power plant programme slowed down. Much is being said about a "national fuel policy" by which people would virtually be directed to use a particular fuel and no other. Although at the moment such a policy is aimed at oil, past experience suggests that control would go further than that and be extended to electricity. The fact that the electricity supply industry is the National Coal Board's best customer is ignored by some advocates of a fuel policy.

NUCLEAR REACTORS FOR SHIPS

At the Admiralty last week, a wealth of information on various different types of possible nuclear reactor systems for ships was discussed. The eight different systems which were considered ranged from the "Calder Hall" type to a heavy water reactor and details are given elsewhere in this issue. The proposers of each system appear to have gone to some length to impress the Admiralty that their particular type of reactor was better suited to marine propulsion than any other, and the Admiralty technical committee will have a very difficult task in judging which system or systems should be adopted.

The 1957-58 report of the United Kingdom Atomic Energy Authority referred to the previous work of an Admiralty committee. One conclusion was that a scaled-down version of the present Calder Hall type of reactor would not be suitable for marine propulsion. Nevertheless, in submitting its proposals, the General Electric Co. states that its design study has demonstrated that an improved Calder Hall type of reactor has more to offer than any other system.

MEASURING MANUFACTURING ACTIVITY

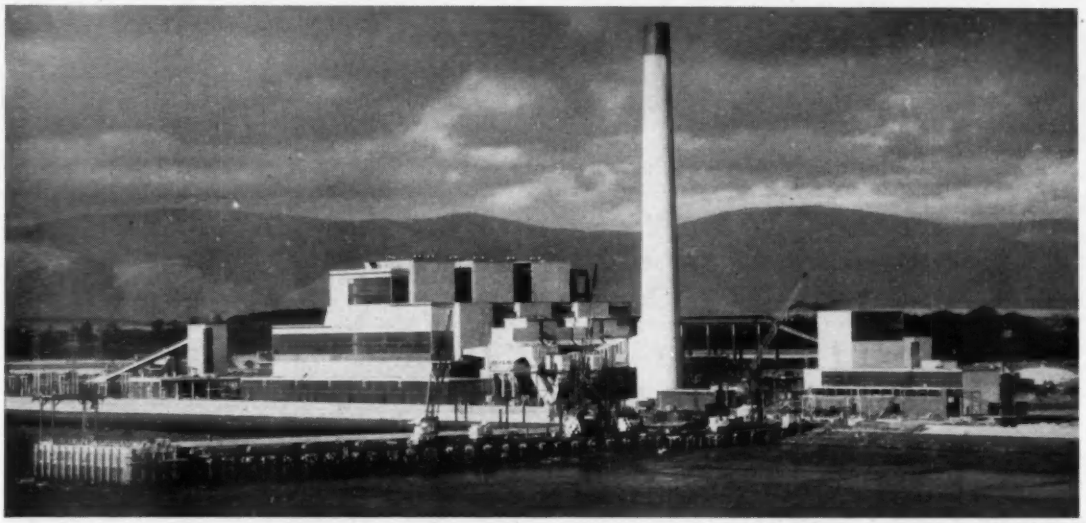
The new statistics which the Board of Trade is publishing on the home and export deliveries and order books in the mechanical and electrical engineering industries are most welcome. It will now be possible for the first time to obtain a regular up-to-date picture of the progress of the electrical manufacturing industry. In the previous statistics there were many gaps. Now one of the most important of these, the production of transformers, switchgear and control gear, has been filled.

Unfortunately the value of the additional information on the state of order books is somewhat diminished by the publication of a single index covering both the mechanical and electrical industries. Since 1948 electrical engineering has expanded about twice as fast as mechanical engineering and this, apart from any other consideration, makes it desirable that the Board of Trade should consider providing a separate index for each industry.

The figures now published are those which the Government requires for its own use in assessing the trends in the country's economy. The collection of more detailed figures of, for example, the production of individual domestic electrical appliances, which are of primary value to manufacturers, will become the responsibility of the industry. The British Electrical and Allied Manufacturers' Association is already seeking the support of its members and other firms in the electrical industry in providing these details. It is to be hoped that manufacturers will realise that it is in their own best interests to co-operate in providing (and later using) the required information.

FINANCING CO-OPERATIVE RESEARCH

It is encouraging to note in the report of the Electrical Research Association for 1958 that at last the financial affairs of the Association have reached a stage where there is no longer any immediate cause for alarm. This time there was a deficit of only £3,732 on the year's working as compared with £9,659 for 1957 and £22,624 for 1956. Last year it had become evident that to continue on the present rate of working the Association needed an increase of regular subscription income of £50,000 per annum, and it is evident from the present report that this objective has been achieved. Judging by the above figures the Association is now heading in the right direction and will not have to curtail the valuable work which it does.



General view of Kincardine with the intake works in the foreground

Kincardine Generating Station

FIRST 120 MW UNIT COMMISSIONED

This 760 MW station will contain three 120 MW and two 200 MW turbo-alternator/boiler units. The steam conditions at the turbine stop valve for the first three units are 1,500 p.s.i. and 1,000 deg F with reheating to 1,000 deg F. The second section, with the 200 MW units, has been designed for steam conditions of 2,350 p.s.i. and 1,050 deg F with reheat to 1,000 deg F. Interesting features are : a dry dust handling plant and attrition type p.f. mills with integral exhausters

THE first Parsons 120 MW unit at Kincardine was commissioned on 28th December, 1958, 44 months after the first contract, for the access road, was placed. This set is double the size of the largest generating unit in Scotland at the present time and, it is estimated, will operate at a sent-out efficiency of over 33 per cent. The station, which is situated in Fife half-a-mile west of the Kincardine road bridge over the River Forth and ten miles south-east of Stirling, will ultimately contain three 120 MW and two 200 MW turbo-alternator/boiler units. The second set is due for commissioning later this year, the third 120 MW unit in 1960, and the first and second 200 MW units should be operating in 1962 and 1964 respectively. The 200 MW units are briefly described in this article as the contracts have only recently been placed.

The single main building is being constructed in two sections, the first part, to contain the three 120 MW units, has been completed with a temporary gable and work will start in a few months on the extension to accommodate the two 200 MW units. The circulating water system civil works and the coal handling plant are being constructed for the fully developed station. The design for the whole station was commenced by the then British Electricity Authority and, since April, 1955, has been carried out by the South of Scotland Electricity Board with the continued assistance of the consulting engineers.

The station site, which amounts to about 137 acres, is situated on river foreshore reclaimed in 1822. At that date, an embankment with a top level of +13ft O.D. was built but, as the river level was known on one occasion to have exceeded this value, the embankment has been strengthened and raised to +16ft O.D. Alluvial deposits overlay the bed rock at varying depths. The main building is sited where the depth to rock head is such that mass concrete foundations on rock could be employed; for some ancillary buildings and for parts of the c.w. culverts where the depth to rock was much greater, piled foundations were used, the piles being cast on site. Coal seams were worked locally in the 18th century but bores indicated that the old workings did not extend below the main and ancillary buildings and the chimney area.

The site was chosen due to its proximity to the surrounding coal mines and the availability of ample supplies of cooling water from the River Forth at all states of the tide. The station is also well placed near the load

centre of the Scottish Lowlands. Both furnace and fly ash will be deposited on a site three miles downstream throughout the expected life of the station. This site, which extends to some 275 acres, will be reclaimed from the River Forth and will eventually provide valuable agricultural land.

The main building is of steel-framed construction with brick and aluminium cladding. The first 20ft of walling comprises off-white Uxbridge flint brick and a dark blue brick has been used for the next 20ft. Above the brickwork the cladding is square-formed aluminium sheeting and patent glazing. The aluminium sheets have been treated by a special dip process which improves weathering and produces a pale green sheen. The administration block and workshops, which are situated to the south of the main building, form a long low group, 700ft in length. Both blocks are linked to the main station by enclosed foot bridges.

The turbine room for the complete station is 528ft long by 120ft wide by 90ft high and the complete boiler house is 528ft long by 193ft wide by 158ft high. These widths do not include the switchgear annexes. The combined volumes of the buildings give a figure of 28 cu ft/kW of installed capacity for the complete station and nearly 30 cu ft/kW for the three 120 MW units. The complete station will have two circular brick chimneys lined with acid-resistant brick, 400ft high, with a top diameter of 24ft.

The estimated cost of the complete station is about £40·4 million based on present-day costs, equivalent to £53/kW for the total 760 MW installed capacity. The station is intended for base load operation, but the plant is also designed so that it can be operated on a two-shift basis, if this is required in the future.

The site lies below the river high water level and four 6,000 gal/hr Gwynnes pumps are installed in the surface water pump house to deal with site drainage, rain water and various effluents. The pumps are automatically started in a pre-arranged sequence when the water level in the pump suction chamber rises to predetermined levels. The water is discharged through two 36in pipes to the c.w. outfall.

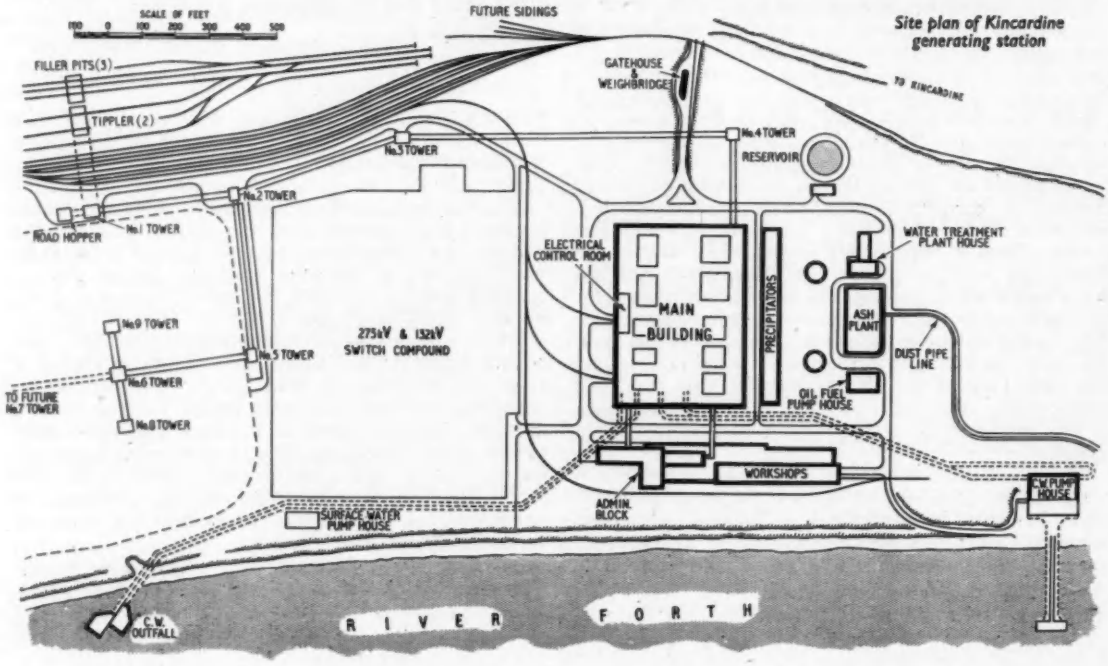
Coal Handling Plant

The daily consumption of fuel for one 120 MW unit working on a three-shift basis is 1,325 tons and the weekly consumption for the whole 760 MW station will be 53,200 tons. The coal, of an average calorific value of 9,700 B.Th.U/lb, is normally supplied by rail to the station sidings. A ground hopper for road-borne coal is provided for emergency use.

The greater part of the coal supplies will be delivered in hopper bottom wagons, marshalling being carried out by diesel locomotives to three filler hoppers. Two Strachan & Henshaw wagon tipplers are provided for use with flat bottom wagons which are handled by electrically operated beetles. The beetle travels along its own track within the railway lines and extends arms to engage with the wagon wheels hauling it on to the tipplers. Out-haul beetles are also provided.

Two 48in 600 tons/hr belt conveyors take the coal from the filler or tippler hoppers to No. 1 tower. From No. 1 tower, two 600 tons/hr conveyors feed No. 2 main junction tower. These conveyors also receive coal from the road-borne hopper. Magnetic separators and coal sampling points are provided in No. 2 tower together with screening and crushing facilities. From the single hopper in the tower, coal can be fed either on to one of two 600 tons/hr conveyors to No. 3 tower on the way to the boiler bunkers or on to a single 60in 1,200 tons/hr conveyor to No. 5 tower. From No. 5 tower, a further 1,200 tons/hr conveyor feeds the central No. 6 stocking-out tower. This feeds Nos. 8 and 9 towers which are equipped with single 600 tons/hr radial conveyors. A further stocking-out tower with two radial conveyors can be installed in the future, if required.

The present coal store has an area of 13 acres and can store 160,000 tons of coal at an average depth of 12ft. Coal is reclaimed from the storage areas by bulldozers into ground hoppers at the bases of Nos. 8 and 9 towers



which feed via 1,200 tons/hr conveyors to Nos. 6 and 5 towers to the hopper in No. 2 junction tower. Coal fed to the boiler bunkers passes through No. 3 tower which incorporates trash screens and thence via two 600 tons/hr conveyors to No. 4 tower which contains coal sampling points and magnetic separators. From this tower, coal is fed to the station via two 600 tons/hr conveyors provided with Blake-Dennison automatic belt weighers. The conveyor system is remotely controlled from a central panel in No. 2 tower and is sequence interlocked.

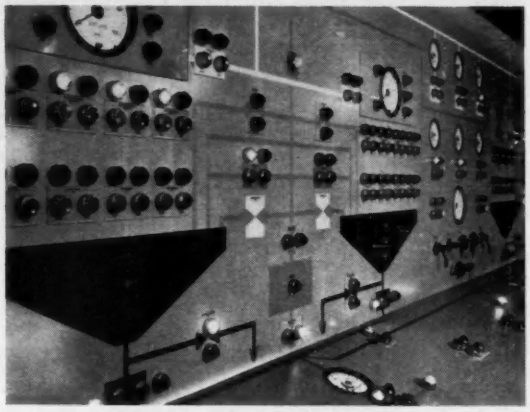
The boilers are arranged with the bunkers and firing aisle on the side remote from the turbine hall. This arrangement has the advantages of keeping any milling dust away from the turbine house, shorter steam pipework and the employment of low level bunkers with consequent reduction in building costs. The saving in cost is counterbalanced to some extent by the extra length of gas ducting spanning the bunkers. There is one gunite-lined boiler bunker of 1,400 tons capacity for each 120 MW unit.

On arrival at bunker level, the coal is discharged from the belts by means of automatic travelling belt trippers, which may be controlled to feed one or more bunkers as required. In the case of No. 1 boiler, coal is fed to the mills via Simon automatic weighers and thence to International Combustion feeders mounted on the mill casing. Five Lopulco LM16 mills are provided for No. 1 boiler and four of these can carry the full load on the boiler. These mills are driven by 200 h.p., 415 V Laurence, Scott induction motors.

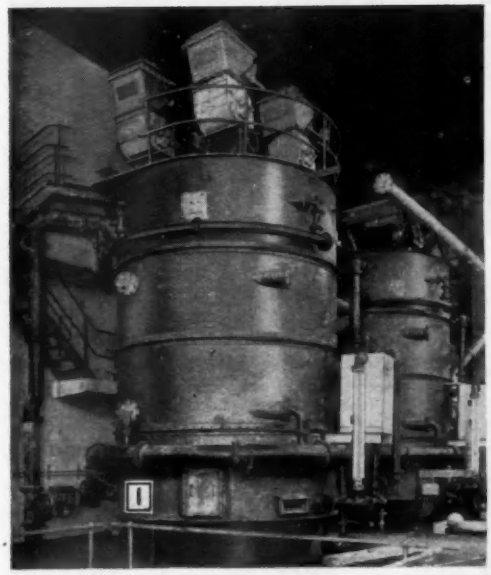
The mills for Nos. 2 and 3 boilers are of the attrition type and consist of a combined mill, exhauster and classifier. They are supplied with coal through Avery weighers and rotating drum type feeders. Four Brown-Riley duplex mills are provided for each boiler and three can carry the full load on the boiler. They are driven by 600 h.p., 6·6 kV, 985 r.p.m. Lancashire Dynamo & Crypto motors through reduction gearing.

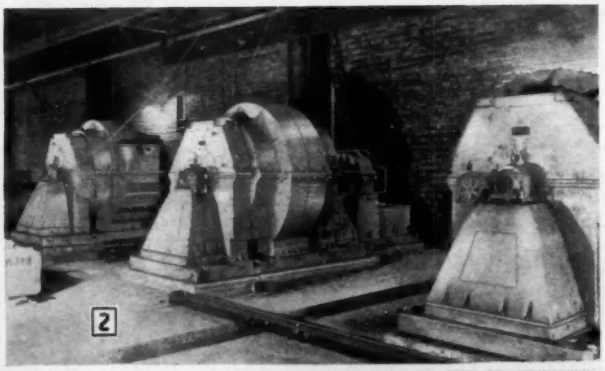
Air for combustion is drawn from the top of the boiler house by two Howden 172,000 cu ft/min forced draught fans driven by 495 h.p., 6·6 kV Bruce Peebles motors through hydraulic couplings at 990 r.p.m. for No. 1 boiler. For each of Nos. 2 and 3 boilers, the two Howden 160,000 cu ft/min f.d. fans are driven by 440 h.p., 6·6 kV Metropolitan-Vickers motors through hydraulic couplings at 730 r.p.m. The f.d. fans supply air to the burners and mills via Howden-Ljungstrom rotary air heaters which raise the air temperature to 460 deg F. The fuel-air mixture is drawn from each mill through the classifiers and thence to No. 1 boiler burners by a two-stage International Combustion exhauster driven by a variable-speed 275 h.p., 415 V Laurence, Scott motor.

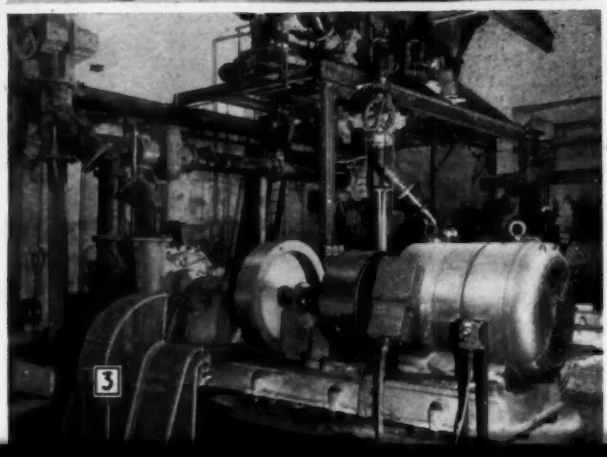
Four p.f. burner boxes are provided on No. 1 boiler arranged one in each corner. Each consists of five tilting burners so that by means of tangential firing, high turbulence is obtained in the furnace. Each mill group supplies one ring of burners. Two propane gas ignited



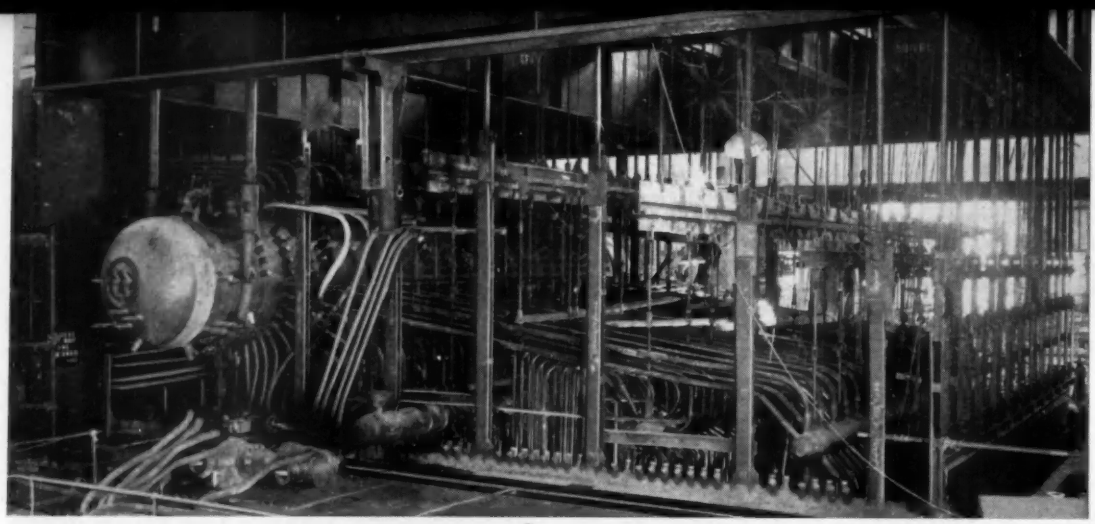
Ash disposal plant control-panel







1. Ash disposal plant mixers. 2. The p.f. mills with integral exhausters for No. 2 boiler. The driving motors have not yet been installed. 3. Ash disposal pump showing flywheel and fluid coupling

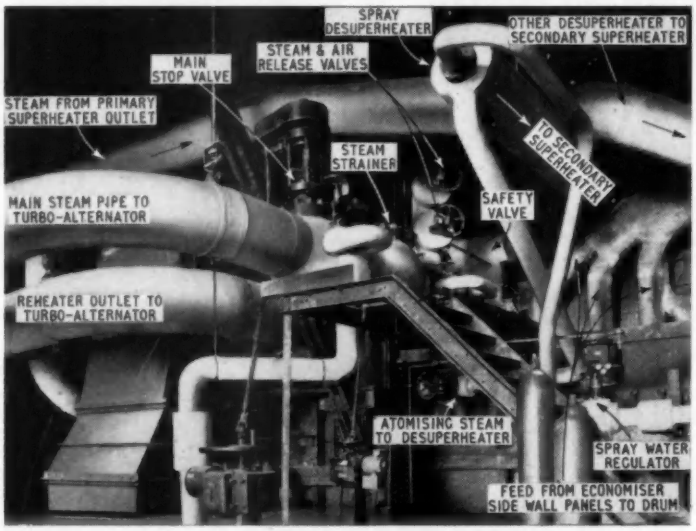


View at drum level of No. 2 boiler under construction

1,125 lb/hr oil lighting-up burners are provided at each corner. The viscosity of the oil is 950 sec Redwood No. 1 at 100 deg F and is supplied at 450 p.s.i. to the pressure atomising burners from the two 150 ton capacity oil tanks. These burners can carry 12 per cent of full load and are of a non-retractable, tip shut-off type and require a circulation of oil for cooling purposes when not in use. The oil pumping system comprises two l.p. pumps, four 250 kW l.p. heaters and four h.p. pumps in series. The h.p. pumps are operated only when oil firing and the l.p. pumps maintain the circulation at other times. Flame failure protection is provided and provision has been made to install an industrial flame-observation television system at a later date.

The combustion chamber of Nos. 2 and 3 boilers is designed for front wall firing. There are 16 burners arranged in four rows of four. Four air atomisation oil burners for starting-up from cold are provided as well as twelve pressure atomisation oil burners for lighting the associated pulverised fuel burners only. Gas ignition is provided. The oil pressure for the starting-up burners is 100 p.s.i. and each burner has a capacity of 200 to 1,000 lb/hr. The pressure burners have a capacity of 200 to 500 lb/hr and the oil is supplied at 450 p.s.i.

Main steam and reheat piping at drum level of No. 1 boiler



After combustion, the gases traverse the various sections of the superheater, reheater, economiser, air heaters, Howden Multi-Vortex mechanical grit collectors and Lodge-Cottrell electrostatic precipitators and are discharged to the flue by the induced draught fans. For No. 1 boiler, the two Howden 270,500 cu ft/min i.d. fans are driven by 1,017 h.p., 6·6 kV Bruce Peebles motors through a hydraulic coupling at 970 r.p.m. The i.d. fans for Nos. 2 and 3 boilers, also supplied by James Howden, are rated at 242,000 cu ft/min. They are driven by 860 h.p., 6·6 kV Metropolitan-Vickers motors through hydraulic couplings at 970 r.p.m.

Ash and Dust Handling Plant

Each of the first three boilers may produce up to 35 tons of furnace ash and 220 tons of fly ash daily, depending on the ash content of the coal. The furnace ash is extracted from the boiler ash hoppers by high-pressure sea water jets and conveyed along high-velocity sluices to ash sumps, where it is allowed to settle and is then transferred by grabbing cranes to a drainage apron for disposal by road to Longannet, some three miles downstream. The two ash sluicing Gwynnes pumps at present installed are rated at 2,650 gal/min and are driven by 325 h.p., 6·6 kV L.D.C. motors. The sluicing water is recirculated.

The fly ash extraction plant is an air pressurised extraction system, remotely controlled. The grit from the economiser, air heater and chimney hoppers is withdrawn by rotary feeders and jet blowers and blown through pipes to an intermediate bunker by compressed air supplied at 60 p.s.i. This air is supplied by Howden-Ljungstrom air compressors running at 6,000 r.p.m. and driven through gearing by 250 h.p., 415 V L.D.C. motors.

The grit from the intermediate bunker, mechanical grit collectors and the twelve precipitator hoppers is conveyed by means of ceramic air slides to a surge hopper mounted over the main dust pump. This pump takes the form of a conical-shaped tank supported on springs and was supplied by Kennedy Van Saun Manufacturing & Engineering Corporation of New York, U.S.A. It has a pumping capacity of 40 tons/hr and operates intermittently in the following

manner. The tank moves downwards under the weight of the dust against its support springs. At a predetermined position, the dust inlet valve at the top of the tank is closed and air is supplied to agitating nozzles and a blowing unit at the base of the tank. The latter discharges the tank and blows the dust to the fly ash disposal pump house. As the tank empties, it lifts and all valves return to the loading position.

In the disposal pump house, the fly ash is received into 250 ton storage bunkers, two of which are at present installed. From these bunkers, it is fed by variable-speed rotary feeders into the mixers situated underneath. Sea water from the c.w. system is pumped into the mixers via tangentially aligned nozzles at a controlled rate to maintain a specified level in the mixers. The concentration of the mixture is measured by a γ-ray instrument of Isotope Developments, Ltd., in the pipeline between the mixer and disposal pumps. This instrument is used to control the variable-speed rotary feeders to maintain the slurry concentration within close limits of the desired value of $3\frac{1}{2}$ lb of dust per gallon of water. The three disposal pumps (one standby), each of which has a capacity of 2,030 gal/min of slurry (190 tons/hr dust), pump the slurry via two asbestos cement pipes to Longannet.

The control panels in each of the two sections of the plant incorporate a mimic diagram and provide remote push-button selection with sequence interlock.

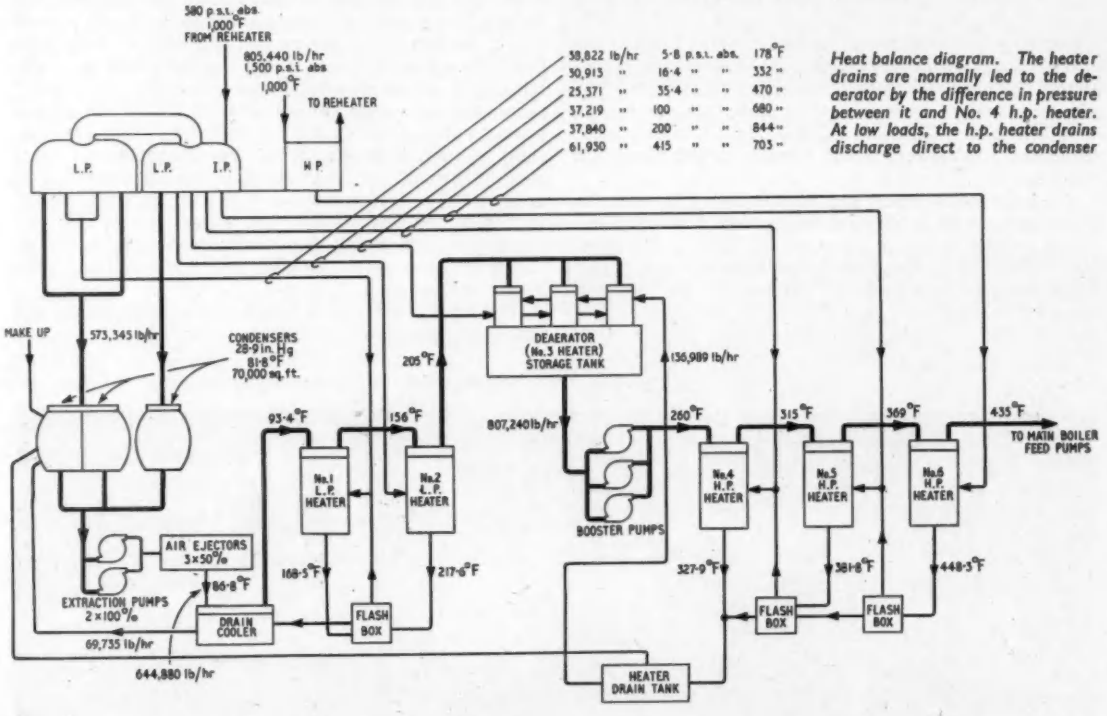
Steam Raising Plant

Each of the first three boilers has a maximum continuous evaporative capacity of 860 klb/hr when supplied with feed water having a temperature of 435 deg F at the economiser inlet. The steam conditions at the superheater outlet are 1,600 p.s.i. and 1,010 deg F with reheating from 697 deg F to 1,005 deg F.

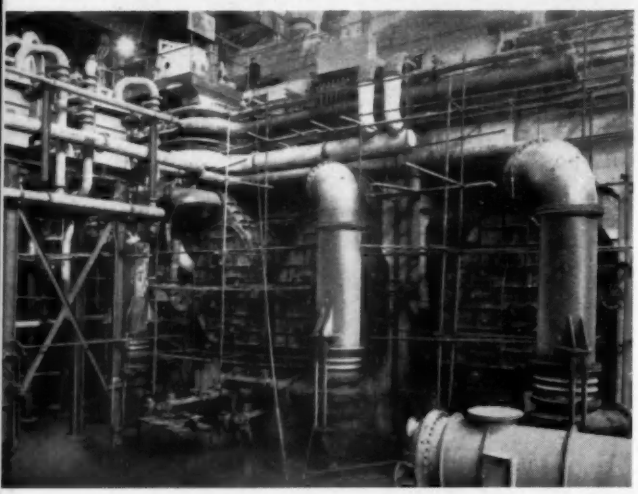
The single-drum boiler for No. 1 unit was supplied by International Combustion, Ltd. It consists of a natural circulation water-tube radiant type furnace with an effective heating surface of 16,295 sq ft, primary and secondary superheaters, reheater and economiser. The whole boiler is slung from the main steelwork, the total weight being approximately 2,500 tons. The furnace dimensions are 92½ft high with a cross-section of 33ft by 27ft. The primary superheater is in two banks and is of the horizontal self-draining type with a total effective surface area of 35,920 sq ft. The secondary superheater is also in two banks but is of the pendant type and has a total effective surface area of 7,540 sq ft. Interposed between the primary and secondary superheaters is a pair of spray type desuperheaters which control the steam temperature within ±10 deg F of the design figure from 50 to 100 per cent of m.c.r.

The reheater is situated between the primary and secondary superheater banks and consists of a self-draining vertical and horizontal section with a total effective surface area of 13,700 sq ft. The reheat steam temperature is automatically controlled by the corner tilting burners which are pneumatically operated. Provision has been made for manually controlled spray desuperheaters situated in the reheater inlet pipework for emergency conditions. A gas by-pass damper is fitted in part of the reheater circuit. In addition, there are two gas recirculating fans to return the gas from the economiser outlets to the bottom of the furnace. The gilled sleeve Senior economiser is divided into four banks and has an effective heating surface of 126,298 sq ft.

On-load cleaning of the boiler is catered for by automatic sequence electrically-operated sootblowers supplied by the Ivor Power Speciality Co. There are twenty retractable gun-type blowers for the furnace and ten retractable lance blowers for the superheater and reheater. It is intended that, at 120 MW, the burners shall be in their best regulating position (namely, horizontal), with no gas recirculation, no reheater inlet spray and 10 per cent gas by-pass of the reheater.



Heat balance diagram. The heater drains are normally led to the deaerator by the difference in pressure between it and No. 4 h.p. heater. At low loads, the h.p. heater drains discharge direct to the condenser



No. 1 unit condensers and air ejectors

In general, the layout and conditions of the Nos. 2 and 3 boilers, made by John Brown Land Boilers, are similar to No. 1 boiler. The combustion chamber in this case is designed for front wall firing. The furnace has a height of 106ft with a cross-section of 34ft by 27ft and a total effective heating surface of 11,740 sq ft. The two-bank secondary pendant superheater has an effective heating surface of 4,600 sq ft, the first bank being positioned at the top of the front wall in the radiant zone. The reheater is situated in a gas pass path parallel to the primary superheater and control of reheat temperature is obtained by proportioning the gases between the reheater and the primary superheater by means of dampers below the parallel economiser. The effect of this on superheater temperature is corrected by means of spray desuperheaters. Spray desuperheaters are also provided in the reheater circuit for emergency use. The primary superheater has an effective heating surface of 35,100 sq ft and the reheater 40,640 sq ft. The plain tube economisers have a total effective heating surface of 36,900 sq ft. There are 24 Clyde electrically-operated retractable sootblowers in the furnace, superheaters and reheater.

The main steam reheat and feed pipework between the boiler and turbine is supplied by Aiton & Co., Ltd., and is butt welded except in a few special cases. The pipework subjected to the superheater and reheater outlet temperature is composed of chromium-molybdenum-vanadium alloy steel.

Automatic boiler combustion control for all three boilers is carried out by Bailey Meters pneumatic systems. Variations in main steam pressure are sensed and transmitted to the f.d. and exhauster fans for No. 1 boiler, and to the mill variable-speed feeders. The mills/exhausters for Nos. 2 and 3 boilers are driven at a constant speed. Variations in f.d. alter combustion chamber pressure and this in turn adjusts the i.d. fans to the required combustion chamber draught conditions. Feed water control is achieved by means of a Bailey three-element type of regulating valve which is designed to respond to the boiler drum water level and the steam and feed water flows.

Each boiler has two direct-mounted water level gauges, two remote Hopkinsons combined level gauges and alarms and a level recorder in the plant control room. An Igema remote level indicator is situated on the operating floor level adjacent to the feed control valves. There are four Hopkinsons torsion bar safety valves on the boiler drum and three on the superheater, one of which is electrically assisted.

Nos. 4 and 5 Babcock & Wilcox boilers for the 200 MW units will each have a maximum continuous evaporative capacity of 1,350 klb/hr with feed water at 474 deg F. These boilers will be of the natural circulation water-tube radiant type with a single furnace and horizontal circular burners. The steam conditions at the superheater outlet will be 2,450 p.s.i. and 1,055 deg F with reheating to 1,005 deg F.

Turbines

The first three turbo-alternators are of Parsons manufacture and are rated at 120 MW. They are of the impulse-reaction type, run at 3,000 r.p.m. and are designed to operate with steam conditions at the turbine stop valve of 1,500 p.s.i. and 1,000 deg F with reheat to 1,000 deg F and 365 p.s.i. before entry to the i.p. cylinder. The turbines have three cylinders with a triple-flow exhaust. The h.p. cylinder is of the double-shell type and has a single velocity-compounded impulse stage and 11 reaction stages. The i.p. cylinder has 17 reaction stages and incorporates, in addition, part of the l.p. section of the turbine taking one-third of the total flow through eight stages to the exhaust pressure. The remaining two-thirds of the flow leaves the i.p. cylinder before the l.p. section and is transferred by twin overhead pipes to the centre of the l.p. cylinder, which contains eight reaction stages in double flow arrangement. After passing through the l.p. turbine, steam exhausts to twin condensers, a third condenser taking steam from the l.p. section of the i.p. cylinder. At a load of 120 MW and a vacuum of 28·9in Hg, the specified steam and heat consumptions are 6·712 lb/kWh and 8,200 B.Th.U/kWh respectively.

The h.p. cylinder is reversed to minimise thrust and differential expansion problems. The h.p., i.p., l.p. and

No. 1 Parsons 120 MW turbo-alternator

alternator shafts are solidly coupled and only one thrust bearing is required. This bearing is situated between the h.p. and i.p. cylinders and locates the shaft axially. The outer casing of the l.p. turbine is anchored to the foundations by transverse dowels at the i.p. end. It is centred laterally by adjustable tie bars fixed to the foundation block at the dowelled end and by central lugs engaging in a bracket on a transverse member at the generator bedplate. The exhaust end of the i.p. cylinder is bolted to the outer casing of the l.p. turbine. The steam inlet ends of both h.p. and i.p. cylinders have palms resting on, and locked to, an intermediate bearing block which is free to slide in conformity with i.p. expansion on Muntz metal plates on the bedplate. The front end of the h.p. casing has the same arrangement.

Governing is by throttling through two valves acting in parallel on each of the two steam chests. The main centrifugal governor and the main pilot and the seal oil pump are driven from the same shaft by helical gearing from the h.p. turbine. With increase in speed, the governor weights rise and allow more pilot oil to escape to drain. This reduces pilot oil pressure which has the effect of reducing the governor valve lift. The setting of the pilot oil pressure can be varied by manual or remote electrical regulating gear. With manual control, speed can be varied by −6 per cent to +12½ per cent or, with remote electrical control, the range is limited to −6 per cent to +6 per cent.

An auxiliary governor, main power and lubrication oil pumps are driven from a separate geared shaft from the h.p. turbine. This governor is provided to ensure rapid operation of the reheater interceptor and release valves in the event of overspeed. The two interceptor valves are held open and the two release valves held shut by the power oil system. There are two overspeed governors incorporated in a single unit bolted on to the h.p. shaft. When a predetermined overspeed is reached, an eccentric bolt overcomes a spring pressure and releases the emergency trip plunger.

The main gear-driven lubricating pump supplies oil at a pressure of 20 p.s.i. to the bearings and thrust blocks. The gear-driven power oil pump discharges oil at a pressure of 100 p.s.i. for operating the steam valves. Oil for the operation of the pilot pistons of the main governor valves and the supply to the generator hydrogen seals is discharged at 70 p.s.i. by the gear-driven pilot and seal oil pump. This oil pressure is regulated to about 25 p.s.i. at the seals.

A 100 per cent duty a.c. motor-driven lubricating, power, pilot and seal oil standby pump is provided to cut in when bearing pressure falls below a certain value. In addition, there are a.c. and d.c. motor-driven emergency lubricating oil pumps and seal oil pumps.

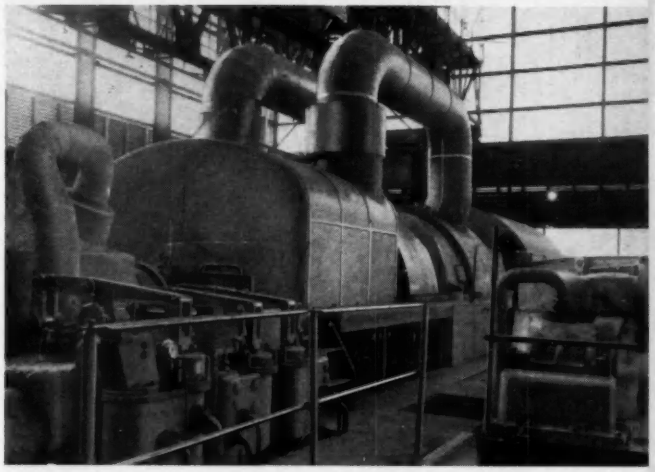
Unloading gear is provided to limit the turbine output by closing the governor valve if the vacuum falls to 22in Hg or if the stop valve pressure falls a predetermined amount below normal. If the vacuum continues to fall, at 15in Hg a vacuum operated switch is arranged to trip the emergency stop valves. An anti-motoring device is also incorporated.

A large number of indicating and recording instruments have been provided for measurement of steam and metal temperatures on both the boiler and turbine. To limit thermal stresses during starting, flange heating has been provided on the h.p. and i.p. turbine cylinders.

The turbovisory equipment consists of eccentricity and differential expansion detectors on h.p., i.p. and l.p. shafts together with vibration detectors on each pedestal bearing.

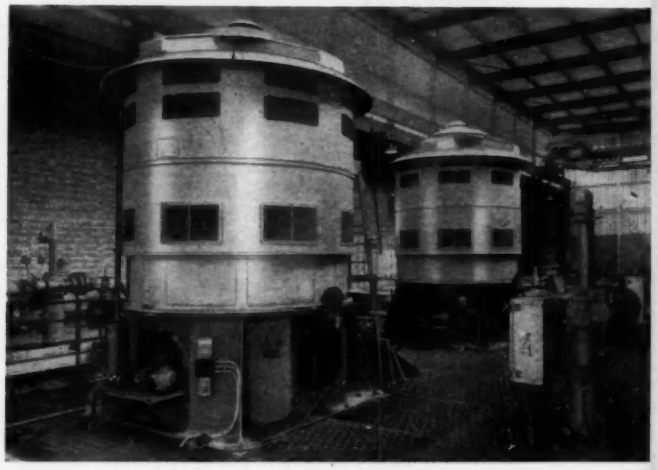
The triple-flow exhaust from the turbine passes into the three-shell double-flow surface condenser which has a total cooling surface of 70,000 sq ft. The condensers are designed to give a vacuum of 28·9in Hg at m.c.r. when supplied with 60,000 gal/min of cooling water at 55 deg F. Condensate is extracted by two 100 per cent duty two-stage pumps having a capacity of 725,000 lb/hr and driven by 155 h.p. 415 V motors. Air is removed by three 50 per cent duty Parsons steam operated air ejectors. One quick-start exhauster is also provided.

Nos. 4 and 5 turbo-alternators will be supplied by the General Electric Co., Ltd. They will be arranged longitudinally in the turbine hall and have a capacity of 200 MW. The turbines will be designed to operate with steam conditions at the turbine stop valve of 2,350 p.s.i. and 1,050 deg F with reheat to 1,000 deg F. The exhaust area will be adequate to take continuing advantage of vacuum down to 0·8in Hg abs. which may be expected from low c.w. temperature during the winter period. The feed heating will be in seven stages and will be supplied by G. & J. Weir, Ltd. The alternators will generate at 16 kV and have a rating of 200 MW at 0·85 power factor.

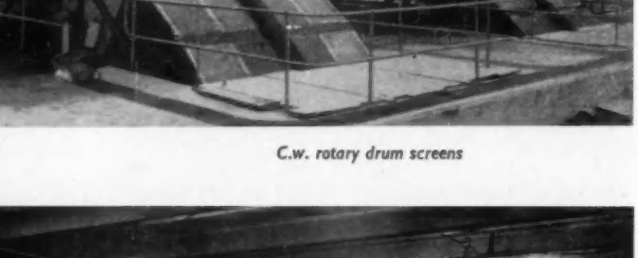


No. 1 turbo-alternator showing main valves. The reheater interceptor valve can be seen at the right

C.w. pump house showing two of the four 1,017 h.p. pumps



C.w. rotary drum screens



Plant control room showing panels for No. 1 unit

The rotors will have hollow conductors direct cooled by hydrogen at 50 p.s.i. and the stator conductors will be liquid cooled. The voltage regulator will be of the magnetic amplifier type as described in the *Electrical Review* of 19th December, 1958.

From the condensers, the condensate passes through a drain cooler, two l.p. heaters, a high level de-aerator heater, three 50 per cent duty booster pumps, three h.p. heaters and is then fed to the boiler by three 50 per cent duty main feed pumps. The Mather & Platt booster pumps each have a capacity of 482,500 lb/hr at 260 deg F with a suction pressure of 47 p.s.i. and discharging at 555 p.s.i. They are driven by 415 h.p., 6·6 kV motors. The main feed pumps are also supplied by Mather & Platt and each has a capacity of 482,500 lb/hr at 435 deg F with a suction pressure of 530 p.s.i. and discharging at 1,965 p.s.i. They are driven by 1,300 h.p., 6·6 kV motors.

There are no booster pumps for Nos. 2 and 3 units. Each of the three 50 per cent duty Harland Engineering boiler feed pumps has a capacity of 485,000 lb/hr at 260 deg F with a suction pressure of 47 p.s.i. and discharging at 2,000 p.s.i. to the h.p. heaters designed, in this case, for full feed pressure. They are each driven by a Harland 1,650 h.p., 6·6 kV water-cooled induction motor.

The three per cent boiler feed make-up water is supplied via Permutit demineralising plant from the Fife County Council town water mains. The plant will have an eventual normal capacity of 30,000 gal/hr. To provide a standby supply in the event of town mains failure, a 1,000,000 gal circular concrete storage tank with pre-stressed concrete walls has been constructed.

Water for condenser cooling and the ash handling plant is drawn from the River Forth at a depth providing adequate coverage at all states of the tide. The only part of the river having the necessary depth occurs at the downstream end of the site, and requires the outfall to be upstream of the intake. The distance of 2,700ft separating the two was chosen as a result of tests carried out on a specially constructed model of that part of the river. By varying the position of the outfall on the model, the minimum separation was obtained giving a satisfactorily low temperature rise at the intake during the period of slack water, low tide.

The intake is equipped with suitable fixed screens. Triple-square underground culverts convey the water to the c.w. pump suction chamber via six 38ft diameter rotating drum screens, four of which are being supplied initially by J. Blakeborough & Sons, Ltd.

The c.w. pump house will incorporate six 65,000 g.p.m. vertical spindle centrifugal pumps. Four are being supplied initially by Drysdale and are driven by 1,017h.p., 6·6 kV Bruce Peebles motors. The c.w. water is delivered to the condensers through twin reinforced concrete culverts and thence to the outfall by similar culverts. Intermittent chlorination of the c.w. system is applied at the main intake.

Each of the first three alternators generates at 13·8 kV and is rated at 120 MW at 0·8 power factor when operating at a hydrogen pressure of 15 p.s.i. The hydrogen is cooled by distilled water in four heat exchangers built into the stator casing. The air-cooled main and pilot exciters are gear driven from the alternator shaft.

The automatic voltage regulating equipment is Metropolitan-Vickers type V.T.S.R., comprising a master and slave amplidyne generator excited by a magnetic amplifier and used to boost or buck the normal self-excitation of the main exciter when the alternator voltage departs from normal. The magnetic amplifier voltage regulator derives its signal voltage from a bridge network of Metrosil semi-conductors which is arranged to give zero output at normal system voltage and a negative or positive output at higher or lower voltages respectively. Facilities are provided for change-over to manual control when the main exciter is energised from a pilot exciter via a motor-operated field rheostat.

Each alternator is directly connected to a 13·8/145 kV, 144 MVA, OFW Bruce Peebles transformer equipped with on-load tap-changing. These transformers are connected by oil-filled cable to the 132 kV, 3,500 MVA Metropolitan-Vickers air-blast switchgear in the outdoor switching station. Six 132 kV lines are being constructed to connect Kincardine to the grid system. For the second half of the station a 275 kV substation is planned. The generator and its step-up transformer are protected as a unit by an overall biased differential protection, negative phase sequence and earth fault protection being provided in addition. The generator transformer is equipped with the normal Buchholz and winding temperature devices and the h.v. winding is covered by balanced earth fault protection. Back-up protection is provided by an inverse definite minimum time over-current relay.

Unit auxiliaries are supplied from a 13·8/6·6 kV, 11 MVA Bonar Long unit transformer, while station supplies are catered for by two 15 MVA, 132/6·6 kV station transformers. For starting purposes, a further two 20 MVA transformers are provided. The 6·6 kV, 250 MVA English Electric air-break switchgear is housed

in two switch annexes running the length of the turbine house and boiler house. The 415 V air-break switch and contactor gear are also situated in these annexes and in various load centres on the site. This 415 V gear is of Whipp & Bourne and M. & C. Switchgear, Ltd.'s manufacture.

The first pair of turbo-alternator/boiler units is controlled from a central plant control room placed between the turbine house and boiler house at operating floor level. All instruments for the control of the boiler and turbine are installed in the plant control room, together with control of the alternator for both loading and switching.

The electrical control room is situated within the main building and from here the 6·6 kV, 132 kV and 275 kV circuits are controlled, as well as the load regulation of the generators. The combined generator control and logging desk provided in this room comprises five generator control panels in the two wings of the desk, the central portion containing the general indication panel, telephone panel and the alarm annunciation windows and keys. The alarm annunciation scheme is of Standard Telephones & Cables' manufacture and covers 275 kV, 132 kV, 6·6 kV and general station alarms. Within the electrical control room will also be situated the fire alarm annunciator, supervising the condition of the system and indicating any area where the system has operated.

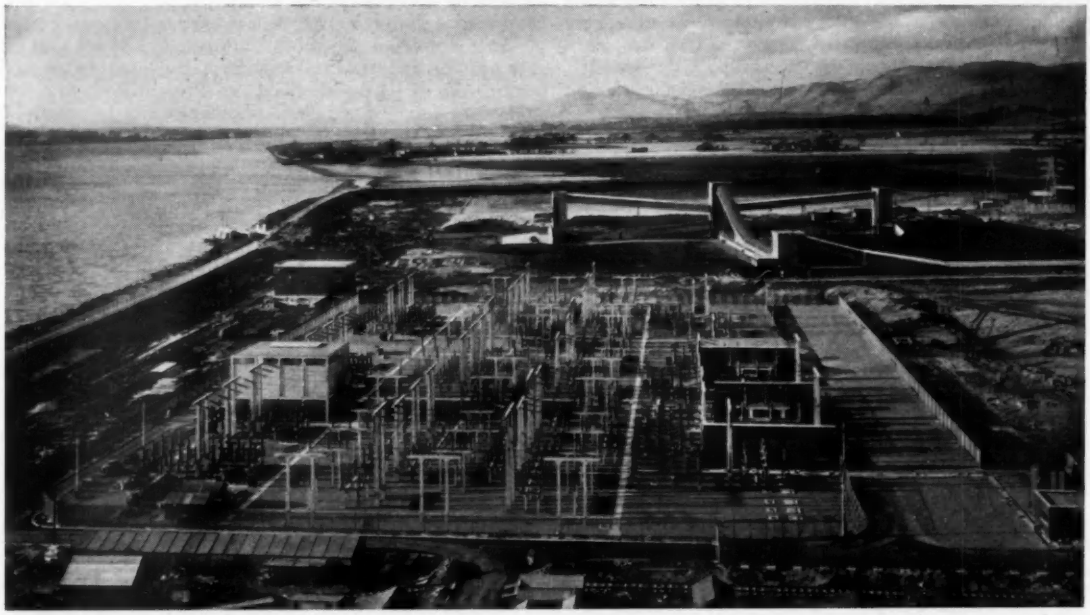
The main consulting engineers are Messrs. Kennedy & Donkin and the civil consulting engineers are Messrs. James Williamson & Partners. The architects are Prof. R. H. Mathew and Johnson-Marshall. The main contractors for the first section are:—Foundations, Holloway Bros. (London), Ltd.; superstructure, Mitchell Engineering Co., Ltd.; steelwork, Redpath Brown & Co., Ltd.; ash disposal works, Mowlem (Scotland), Ltd.; boiler plant, No. 1 set, International Combustion, Ltd., Nos. 2 and 3 sets, John Brown (Land Boilers), Ltd.; turbo-alternators, condensers, feed heating system, C. A. Parsons, Ltd.; 132 kV switchgear, Metropolitan-Vickers Electrical Co., Ltd.; 6·6 kV switchgear, English Electric Co., Ltd.; generator transformers, Bruce Peebles & Co., Ltd.; 132 kV cables, W. T. Henley's Telegraph Works Co.; station h.v. and l.v. cabling, James Scott & Co., Ltd.; coal handling plant, Simon-Carves, Ltd.; ash handling plant, John Thompson Industrial Constructions, Ltd.; precipitators, Lodge-Cottrell, Ltd.

The a.v.r. amplidyne generator and 415 V auxiliary switchgear

The main contractors for the second section containing two 200 MW units are:—Boilers, Babcock & Wilcox, Ltd.; turbo-alternators, the General Electric Co., Ltd., with feed heating and condensing plant supplied by G. & J. Weir, Ltd., Glasgow.

Acknowledgment is due to Mr. J. Henderson, chief engineer, South of Scotland Electricity Board, for permission to publish this article, Mr. A. H. Marsh, generation engineer (construction) and his staff, and Mr. G. Nicholson, station superintendent, and his staff, for invaluable assistance in the preparation of this article.

132 kV switchgear compound and coal storage area



HANOVER FAIR

SOME BRITISH AND FOREIGN ELECTRICAL EXHIBITS

THIS year's Hanover Fair, now the biggest shop window in the world for the engineering industry, was visited by at least 100,000 people daily during its ten-day run. Over 4,500 firms from 25 countries exhibited this year and of these about 1,200 were classified as "electro-technical." Eighty-seven British firms were represented and about the same number from the United States.

The very high level of organisation of the Fair is now taken for granted, but a special feature this year was the imaginative use of exhibitors' products and materials to create original and compelling displays. One enterprising German firm making roller and ball bearings kept the whole of its pavilion, the size of a bungalow, in smooth, silent rotation with exhibits, staff, visitors and all.

Rectifier Developments

The main representation of British electrical engineering at the Fair was provided by the General Electric Co., Ltd., with a large, well-designed stand which attracted a great deal of interest. Perhaps the most significant exhibits on this stand were examples of the most recent developments in pumpless steel-tank mercury-arc rectifiers. The "Com-pak" rectifiers, C7-Mk. 1, rated to give a continuous output of 120 A up to 1,250 V, and the larger unit, C9-Mk. 1, of double this capacity, use liquid cooling to achieve small size and stability. Cathode spot stability, combined with efficient cooling, result in a rectifier with much smaller dimensions than the conventional mercury-arc type and, as the arc path is shorter, with lower voltage drop and higher efficiency. Anchoring the cathode spot simplifies the incorporation of mercury anti-swill features so that the unit is particularly suitable for traction duty. A total of 728 units are being supplied to British Railways for the 25 kV a.c. electrification scheme now in progress. As there is no other comparable rectifier from any other source, foreign users were very interested and the G.E.C. expects good sales abroad.

Another rectifier shown by the company for the first time is a water-cooled assembly of large silicon junction diodes for six-phase operation with four diodes in parallel per phase. With this construction a current rating of 2,700 A at up to 75 V and a power rating of 200 kW has been achieved. Quick-acting fuses protect the diodes from voltage overloads which could destroy the junctions. In the switchgear field the G.E.C. exhibits illustrated the trend to unit construction, interchangeability, and simplicity of maintenance. Two cubicles for medium-voltage air-break switchgear were shown. One housed 30 MVA circuit-breakers rated at 800 A and 200 A in two-tier formation, and the other fused switches in four tiers, with complete segregation of the circuits.

An 11 kV non-extensible ring main unit shown embodies oil switches for full load current, and making in safety on to a fault, with a withdrawable oil circuit for controlling the "tee-off" circuit. The motor control centre on the stand demonstrated the many advantages of rationalised design. Individual units in a range of panel sizes can be plugged in and can be easily withdrawn and replaced. Front access design allows two switchboards to be mounted back to back with common busbars. Cubicles can contain a wide range of starters and switchfuses and changes can be made readily on site by the user. A comprehensive system of interlocking ensures complete safety in operation. The units are extremely neat in appearance and are proving very attractive to large industrial users such as oil companies.

A 36in electric lifting magnet, selected from the G.E.C. range, was used for an ingenious eye-catching display of a gravity-defying ball spinning and orbiting beneath the magnet. The full-scale replica model of a 275 MW alternator with direct-cooled rotor windings and liquid-cooled stator windings was again shown this year. This cooling system is being used for the two 200 MW turbo-generator sets which the G.E.C. is supplying for the Kincardine station described elsewhere in this issue.

An example of the robust construction of all G.E.C. motors for rail traction service is provided by a d.c. motor of the type supplied to British Railways for 1,000 h.p. diesel-electric locomotives built by the North British Locomotive Co.

The stand of the General Electric Co., Ltd.

Also on the G.E.C. stand a subsidiary company, Woods of Colchester, demonstrated aerofoil axial flow fans and an "Airwoods" heat exchanger. A feature of the fans is that any number of stages up to six can be built up from standard units to develop pressures as high as 100in water gauge. It is claimed that the heat exchanger, an oil-fired air heater, designed for use with the fans provides the simplest and cheapest method of supplying hot air through ducting for space heating or drying processes.

In Hall 3, which housed atomic power, steam and hydraulic plant, the Board of Trade, the United Kingdom Atomic Energy Authority, and the Nuclear Energy Trade Associations' Conference displayed descriptive and

Above: The President of the Board of Trade (Sir David Eccles) at the London Electric Wire Co.'s stand. With him are Messrs. A. E. Manning, E. H. Bentley and J. R. Alexander. Right: A view of Hall 13 (Electrotechnical)

propaganda material for British nuclear reactors. The Germans, in particular, are taking a tremendous interest in nuclear power, and films projected at this stand played to packed houses. In one of the outdoor exhibits the A.E.G. featured Germany's first atomic power station.

Group Exhibit

One of the disadvantages of anything as big as the Hanover Fair is that small stands tend to get overlooked and big ones are very expensive. This problem was solved satisfactorily by a group of eleven British firms who formed a consortium for the Fair known as the British Electronic Components Centre. In this group E.M.I. demonstrated for the first time one of the most advanced systems of closed circuit television, the Mark VI, which provides complete remote control of horizontal and vertical camera movement as well as focus and lens selection. A recent addition to the E.M.I. range of precision instruments, the WM 16 oscilloscope, with a bandwidth from d.c. to 40 Mc/s, compared favourably with anything that Continental firms had to offer. Also shown for the first time was the E.M.I. hand and clothing monitor designed rapidly to detect radioactive contamination of people working in nuclear plants.

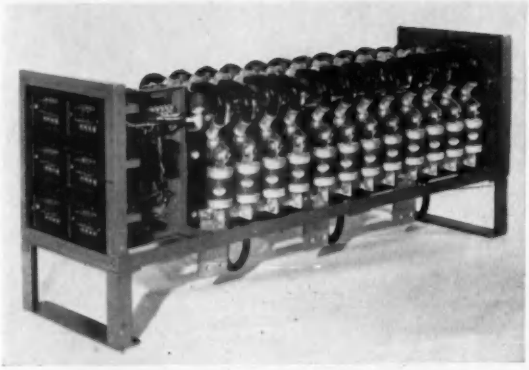
The British Electric Resistance Co. reported great interest in its d.c. motor speed control units, based on its "Regavolt" rotary auto-transformer. These are variable-voltage control units operating from normal 50 c/s supply at 200/250 V in conjunction with d.c. shunt-wound motors to provide an infinitely variable control of speed with good torque characteristics. The shunt field winding of the motor is energised continuously from the a.c. supply through a small bridge-connected rectifier. The armature is supplied from another rectifier whose input voltage is controlled from zero to the mains voltage (or above where necessary). Full field excitation and therefore constant torque is obtained throughout the speed range.

The English Electric Co., Ltd., showed a full range of "C" cores as well as its hermetically sealed and approved open impregnated types of transformers. Painton & Co. displayed new sub-miniature potentiometers which they are marketing in Europe through their Belgian associates. The London Electric Wire Co. & Smiths, Ltd., included in their display their "Class E" enamelled wires and, in particular, "Lewmexbond" which can be wound into rigid self-supporting coils without formers or taping, by heating the wire during the winding operation. The company was distributing a very well-prepared catalogue in English, French, German and Spanish.

Other firms exhibiting in the group included Ardente, Cosmocord, and the Telegraph Construction & Maintenance Co. The Garrard Co. and Birmingham Sound Reproducers, Ltd., each had separate stands for their latest range of automatic record players. A great variety of record players, radio and television receivers and tape recorders were being demonstrated on the vast ground floor of Hall 11 and it was very intriguing to observe groups of visitors listening intently to some very special example of high-fidelity reproduction, apparently quite unaffected by the cacophony surrounding them. The Dictaphone Co., Ltd., showed its new "Model Six Time-Master" dictating machine and other equipment.

Again this year the Rheostatic Co., Ltd., displayed a selection of their "Satchwell" control apparatus through their German concessionaires, the Deutsche Orthotherm G.m.b.H. Among the Kenwood exhibits were the "Dish-master" fully automatic dishwashing machine, which can be pre-set for a six-minute wash or less, food mixers and the "Rotisserie" table top oven. Wilkins & Mitchell showed a complete range of their "Servis" washing machines, including the new "Supertwin" combined washing machine and spin dryer which is not yet available in this country.

Some interesting developments from the Continent were displayed for the first time. The A.E.G., one of the biggest of the German electrical combines, demonstrated a fully automatic welding machine capable of welding steel plates up to 18in thick. The principle, which was originally developed by the Russians for their heavy tanks, is basically that of resistance welding. By using the oxides and slag formed from the steel as a high-resistance material through which a current of 1,000 A is passed, a temperature of about 2,000 deg C is produced in the working area. During a demonstration, two 6in steel plates were positioned in a special jig and, after setting up, the machine made a perfect joint without any interference from the operator. The



Water-cooled six-phase silicon rectifier (G.E.C.)

importance of this technique for the steel structures of atomic reactors will readily be appreciated.

The A.E.G. also showed experimental models of the "Logisticon" which is claimed to be a new development in logic circuit design. Printed circuit units incorporating transistors both as switching and short-term storage elements can be used to perform a programmed switching routine without the use of moving parts, relays, or conventional storage devices. The impression remains after seeing what the Germans have to offer that the British still have a clear lead in the field of computers and data-processing machines. In this connection it was interesting to find that one German firm in the field was acting as an agent for one of the latest E.M.I. analogue computers which they consider to be well in advance of any European competitor.

The French have reached a very high level of development in electrical technology as was clearly shown by their exhibits. Examples of what were said to be the largest high-voltage insulators in production in the world were shown by the Constructeurs Français de Matériel. These, rated at 525 kV, 2,000 A, were being supplied to Russia.

Alsthom had a full-scale model of a new locomotive supplied to the French Railways. The commissioning of the first locomotive of this type, the Bo Bo 16.500, constitutes a considerable event in the evolution of single-phase traction at industrial frequency. This locomotive will haul either the heaviest freight trains on the stiffest gradients or the fastest passenger trains at 90 m.p.h. The change-over from passenger to freight operation is effected by a gear reduction assembly which can be changed by the driver in three minutes when the train is at rest. The weight of the locomotive is less than 18 tons per axle, which is 70 per cent less than in the most modern d.c. type and 25 per cent less than the best single-phase rectifier type. This performance has been achieved by a combination of single-motor bogies of small wheel base, two-speed reducing gear for maximum efficiency on load, and Class H silicon insulated traction motors with a continuous rating of 3,500 h.p.

Synchronous Generators

The Brown Boveri Co. exhibited a new range of constant-voltage synchronous generators from 20 to 1,000 kVA. These machines offer a constant output voltage within ±2 per cent under all service conditions, load variations, load shocks, and temperature variations for reactive or resistive loads. The regulation time is within 3 cycles, i.e. 0·06 sec. Rotor excitation is effected by compounding a basic excitation taken directly from the supply through a choke with an additional excitation from a current transformer in the load circuit. The components are added, rectified by a metal rectifier and supplied to the rotor. Condensers ensure self-excitation even after prolonged shut-down. In operation the generators are quite free from vibration. The Brown Boveri Co. were also sponsoring a new range of very compact squirrel-cage motors designed for mounting directly above high-speed industrial centrifuges. By clever aerodynamic design, which ducts the air at high speed through the whole structure, a very efficient machine has been produced.

A general trend clearly in evidence throughout was the rapid development of equipment for automatic operation of diverse industrial processes. Usually, this involved electronic or electrical control equipment which accounts for the very large proportion of exhibitors in the "electro-technical" category. A good example of this trend was provided by the firm of Boekels who demonstrated a machine for continuous weighing and control of material in movement on conveyor belts. In principle, the device uses the deflection of a bar of magnetic material to generate modulated a.c. voltages which are amplified and converted to continuous reading displays and simultaneously fed back through rotodynes to control belt speed. In conjunction with the weighing machine, a remote control unit, which could be programmed by unskilled operators, fed correct quantities of the material on up to six trucks for transport from the site.

The Fair indicated very clearly the rapid advances in electrical engineering now being made on the Continent, and showed that we can sell abroad only by vigorous effort.

Insulating Oil

THE revised edition of B.S. 148 applies to unused insulating oil, as delivered in tank wagons or drums, suitable for the immersion or filling of transformers, switchgear, and certain other electrical equipment in which oil is required as an insulant or for heat transfer. It does not apply to high-viscosity oils, to oils required for cables or capacitors, or to oils for special impregnation purposes.

Since the 1933 edition and until the 1951 revision this British Standard dealt with six grades of oil—A.0, A.10, A.30, B.0, B.10, B.30—differing in allowable sludge test limits (letter designation) and in required cold test temperatures (number designation). It was found that all requirements could be satisfactorily met by a single grade of oil, even if the sludge limit were at the higher value permissible for the B grades, provided that oils having a tendency to high acidity development on oxidation were excluded. A limitation on the acidity development permissible in the oxidation test was therefore included in the 1951 revision which also standardised on a single maximum pour point of −25 deg F (−31·7 deg C).

Minor technical changes in the present revision, compared with the amended 1951 edition, are deletion of the evaporative loss test which, in view of the adequate limitation of volatility ensured by the specified flash-point, was found to be superfluous, and the improvement of the procedures for acidity determination by the substitution of alcoholic alkali for aqueous alkali. A new appendix has been introduced giving the characteristics of the thermometers used in the various tests.

Copies of this Standard, which is based on information supplied by the British Electrical and Allied Industries Research Association, may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1, price 8s 6d.

Nuclear Marine Propulsion

PROGRESS TOWARDS AN ECONOMIC NUCLEAR MERCHANT SHIP

UNDER arrangements made by the Admiralty and with the agreement of the United Kingdom Atomic Energy Authority, a series of papers was read last week and illustrated by representatives of the Atomic Energy Authority and several British nuclear engineering firms on a variety of reactor systems capable of use in surface ships. The demonstration was given to audiences consisting of the Board of Admiralty and Admiralty naval and civilian staff, the Ministry of Transport and Civil Aviation and other Government Departments, and of the Marine Nuclear Propulsion Committee which sits under the chairmanship of the Civil Lord of the Admiralty. The project was organised to indicate the present state of the nuclear art in the field of ship propulsion.

The papers read discussed eight different reactor systems, not all at the same stage of development. The claims of each system have now to be assessed by a technical sub-committee which the Civil Lord's Committee is setting up to report as early as practicable. On the basis of this report it will be possible to judge which system offers the best advantages, balanced against the time it would take to put the various systems into operation.

Simultaneously with the work of the technical sub-committee, the main committee will be examining ways of financing the first ship. The Ministry of Transport committee on marine nuclear safety will continue its work already begun on the problems of safety in nuclear ships.

Reactor Systems

The eight systems discussed were a Calder Hall type reactor, a high temperature gas-cooled reactor, an advanced gas-cooled reactor, three boiling water reactors, an organic liquid moderated reactor and a heavy water reactor.

G.E.C. Calder Hall type.— The G.E.C. - Simon-Carves design is based on the gas-cooled graphite - moderated reactor which is already well established in Britain at Calder Hall and Chapelcross. Major advances in fuel-element design, however, have resulted in much higher outlet gas temperatures and very much reduced size of the reactor. The total thermal output of the reactor is 150 MW, giving about 50 MW of electrical power. The total weight of the installation is 2,400 tons. The fuel elements are of completely new design, consisting of slightly enriched uranium dioxide canned in stainless steel. They are provided with graphite sleeves as in other G.E.C. reactors.

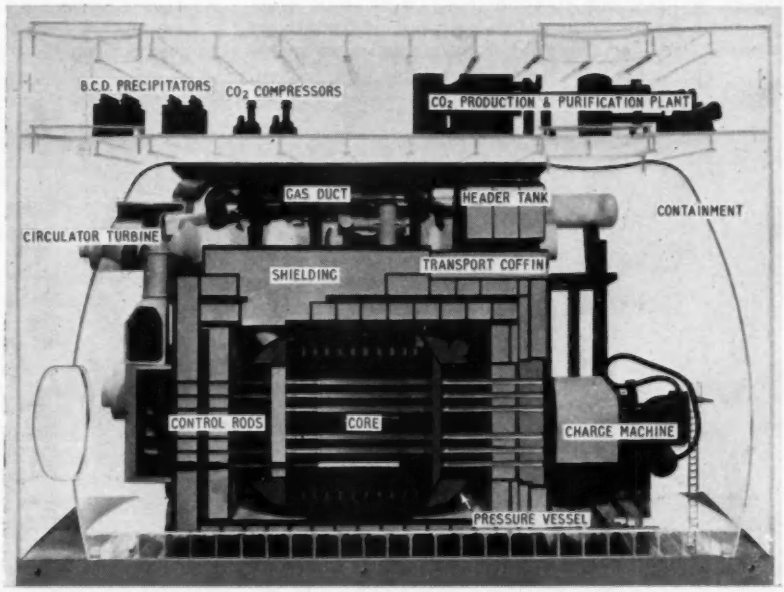
The graphite core is 7½ft in diameter and 6¾ft long and is made up of blocks held together and supported by a surrounding steel structure. The fuel-element channels extend horizontally right through the core and are interspersed with control-rod channels, also horizontal. The reactor pressure vessel is a 14ft diameter horizontal cylindrical vessel with domed ends weighing 125 tons. Charge/discharge standpipes are at one end, and a control rod and emergency access pipes at the other. The main gas ducts are connected through nozzle forgings.

The main shielding structure surrounds and supports the pressure vessel and is made from steel plate. The construction is of an essentially cellular nature and the voids are filled with purified water to act as a neutron shield. This water is circulated through an external cooling circuit. A concrete plug is used at the charge/discharge end of the standpipes.

Four steam-raising units, 7½ft in diameter, are mounted on the outside of the main shielding structure above the reactor. Each has economiser, evaporator and superheater sections. Internal headers are used and all steam/water connections pass out through the specially shaped head at the forward end of the unit. The turbine-driven circulators are mounted at the left ends of these units.

The charge/discharge machine is a pressurised and shielded unit which can be connected to any one of the charge/discharge standpipes, there being one of these for each fuel channel. It is possible to charge fuel with the reactor under load and the ship at sea, should this be required.

The control system consists primarily of a series of neutron absorbing tubes which can be inserted into the graphite core to control the nuclear reaction. A separate



Sectional model of the G.E.C. - Simon-Carves gas-cooled graphite moderated reactor

emergency shut-down system is provided in the form of additional rods housed inside the normal control tubes.

The burst cartridge detection equipment enables a continuous check to be maintained on the conditions of the fuel elements in each channel. It is similar to existing systems.

The containment vessel is a truncated cylinder resting on a flat grillage. It houses all the nuclear and steam raising plant, with the exception of the steam drums, and has the minimum possible number of penetrations. The necessary filtration and cooling plant is supplied and integrated into the system for the cooling of the main shield water.

The control room is the " nerve centre " for the operation of the power plant. Vital controls and indicating/recording instruments are mounted on the reactor control desk and further instrumentation is grouped on a separate control panel. Two further rooms off the main control room house the safety equipment and burst slug detection instrumentation respectively. It is estimated that the first reactor of this type for ship propulsion would cost about £3 million.

De Havilland HTGC reactor.—The high-temperature gas-cooled design proposed by de Havilland incorporates similar basic principles to those of the experimental reactor Dragon which is to be constructed at the Atomic Energy Establishment, Winfrith Heath, Dorset. The reactor core is constructed from blocks of graphite containing uranium and thorium ceramic fuel pellets. The heat produced in these pellets as a result of fission in the uranium raises the core to a temperature level in excess of 1,000 deg C. This heat is removed by pumping helium gas at high pressure through passages in the graphite block. The hot gas then passes through compact, high-pressure boilers which are integral with the main pressure vessel of the reactor and steam is generated at temperatures and pressures suitable for the most advanced types of steam turbine.

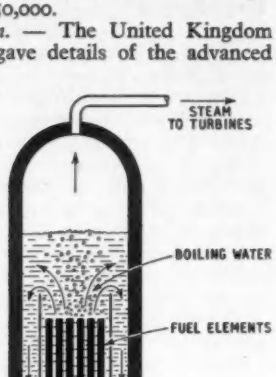
Initially the reactor core will operate about two years at full power without refuelling and it is foreseen that this period will ultimately be made considerably longer. When fuel replenishment is required, the ship would return to a home port equipped with shore-based machines for performing this operation under remote control. With the de Havilland nuclear boiler, an important constituent recovered at this stage is the artificially-produced uranium 233 which can then be used to fuel new reactor cores.

The steam output from a single nuclear boiler will produce 25,000 h.p. at the turbines and this is adequate to power merchant ships and tankers of up to 65,000 tons dead weight. The advanced concept of the design has enabled a low plant cost to be achieved, and a single reactor will cost about £750,000.

U.K.A.E.A. AGR system. — The United Kingdom Atomic Energy Authority gave details of the advanced gas-cooled reactor, a prototype of which is under construction at Windscale.

Babcock pressurised water reactor.—The Babcock & Wilcox pressurised water reactor system is similar to that used by the American nuclear powered submarines. The fuel is enriched uranium and the water is used to transfer the heat from the reactor surfaces to the turbine.

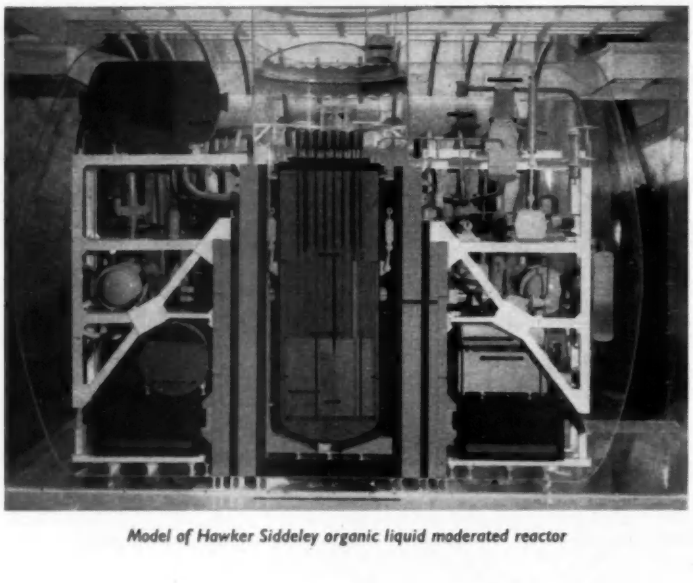
A.E.I. boiling water reactor. — The A.E.I.-John Thompson Nuclear Energy Co. state that their direct boiling water reactor and geared turbines can be delivered in 30 months. Although in this country there is no experience of this type of reactor, it has been successfully operated for some years in the United States, where the General Electric Co. of America has been the leading private industrial exponent. The A.E.I.-John Thompson design is based on this experience and is one result of a long technical association between A.E.I. and G.E.



A.E.I.-John Thompson boiling water reactor concept

Certain core components for the first reactor will be purchased from the American G.E. but, subsequently, the entire unit will be constructed by Associated Electrical Industries, Ltd., and John Thompson, Ltd. The principal advantages of the boiling water reactor for marine propulsion are that it is simple, light and smaller than other types of reactor. It can " burn " plutonium, a considerable advantage for those countries such as Britain with limited capacity for the production of enriched uranium. The reactor pressure vessel is 8ft in diameter, 30ft high and the complete steam-raising unit weighs 1,600 tons, the steam conditions being 1,000 p.s.i. dry saturated.

Mitchell boiling water reactor.—A consortium of three companies, Mitchell Engineering, Ltd., of London, the Fairfield Shipbuilding & Engineering Co., Ltd., of Glasgow, and Combustion Engineering Inc., of New York, have designed a system which is based on a boiling water type nuclear reactor. It is available in two versions giving outputs of 25,000 and 50,000 h.p. Com-


Model of Hawker Siddeley organic liquid moderated reactor

bustion Engineering, Inc., has supplied reactors to the United States Navy for use in American nuclear submarines. The consortium say that their propulsion system could be available for sea-going trials in 36 months from the placing of an order.

Hawker Siddeley organic moderated systems.—The design of the nuclear reactor system presented by the Hawker Siddeley Nuclear Power Co., Ltd., uses a non-corrosive liquid with a high boiling point as the coolant and moderator. As pressure is low, only 100 p.s.i., the reactor vessel and main circuits can be made of mild steel less than one inch thick.

Because of the use of non-exotic materials and the compactness of the system, it is low in capital and running costs and in weight. The reactor can use plutonium when this fuel becomes available in a few years' time, and the replacement of enriched uranium by a mixture of plutonium and natural uranium will make the already attractive economics of the system even better.

Vickers heavy water reactor.—A feasibility study of a heavy water moderated steam cooled reactor has been prepared by Vickers Nuclear Engineering, Ltd. In the steam cooled heavy water reactor system the fuel element design is very simple and employs uranium oxide pellets sheathed in stainless steel cans. Heavy water was chosen as moderator: a liquid poses the least problems in a ship. The heat transfer medium proposed is superheated steam.

ELECTRICAL DEVELOPMENT IN 1958

Thirty-Ninth E.D.A. Annual Report Reviewed

CONTINUED expansion of all the activities of the British Electrical Development Association is recorded in the report of the Council for the year ended 31st December. Progress in emancipation from financial and other restrictions enabled the Association to undertake, in the domestic field, the largest national advertising campaign for many years. During 1958 there was an increase of 68 per cent in the inquiries in the redesigned electrical section at the Building Centre. There were 63 per cent more inquiries on the E.D.A. stand at the Ideal Home Exhibition and 57 per cent more appliances were examined and tested at the E.D.A. Testing House. Perhaps the most outstanding feature of the year, it is stated, was the fresh scope afforded by the establishment of Smoke Control Areas under the Clean Air Act for pressing home the part which electricity can play in clearing the air of smoke and fumes. The Association produced a 25-minute film on the subject and two booklets, one for the information of local authorities and the other for circulation to householders.

The 1958 advertising campaign again concentrated on the development of the two important domestic loads, water heating and cooking, using the slogan "Get up to date—Go Electric" and the campaign symbol of a little boy in a bathtowel. Space was taken in national magazines and newspapers having a combined circulation of 43 million. Four one-minute cinema films on electric cooking and water heating and two 15-second filmlets were completed; and six 30-second filmlets on cooking, water heating and refrigeration were put in hand for showing in 1960. Some 60,000 people visited the redesigned electrical section at the Building Centre and of the 20,302 inquiries, 3,218 came from architects and builders; 9,633 from new property owners; and 7,138 from people converting or adding to existing premises. Inquiries on electric floor warming increased to 11 per cent of the total.

Progress was made with the production of a new booklet on adequate wiring, and a survey of wiring costs on some thirty building estates showed that making the installation adequate need add no more than 1 per cent to the cost of the house. The Association prepared for further discussion with other sections of the industry a scheme for the national approval and marking of domestic electrical appliances. Of the 511 appliances and accessories examined by the Testing House in 1958 293 were tested for manufacturers seeking acceptance of their appliances by Area Boards, or for compliance with the appropriate British Standard. Some 20 per cent of these were confidential reports on prototypes. There was also a big increase, 163 against 63, in the number of appliances examined for the British Standards Institution "Kite Mark" scheme. A new departure was the preparation of "market control" reports on tests made on samples obtained on the open market. The principal work of the Testing House Committee was the compilation of the 1959 edition of the List of Recommended Domestic Electrical Appliances.

The E.D.A./B.S.I. Advisory Committee on Electrical Appliances and Accessories considered forty cases during the year, twenty-eight of which were first submissions and the remaining twelve modified samples. The relatively low figure, it is stated, was due partly to the high standard of the equipment and partly to the fact that manufacturers prefer to submit their appliances direct to the Testing House and to pay for a detailed and confidential report rather than use the facilities of the Advisory Committee. It is perhaps significant, the report comments, that 20 per cent of the appliances examined were of foreign origin. The most frequent cause of complaint was the cheap accessory, mainly plugs and switches.

Following the submission of a memorandum by the Association to H.M. Customs and Excise, an assurance was received that floor warming components would not be subject to purchase tax provided they were not marketed as prefabricated heaters or kits of parts. Indications are not lacking, the report says, that heating engineers in general may soon come to regard electric floor warming as a normal method of heating wherever conditions warrant its use. An original method of calculating the internal temperatures to be expected during periods when current is not available has been formulated for multi-storey buildings with suspended floors. A schedule of electricity consumption in floor-warmed houses was prepared by the Space Heating Sub-Committee, and a special panel was appointed to investigate design loadings for off-peak heating systems.

Three hundred and twenty-one inquiries were passed on to the Electricity Boards from the E.D.A. stand at the Hotel and Catering Exhibition. A new brochure "Electric Catering" and a film "Time for Lunch" were issued during the year. The E.D.A./B.E.A.M.A. Commercial

Catering Committee also prepared a report on electricity in the baking industry and assisted the four Electricity Boards in the North of England in the organisation of training courses for their staffs.

In the industrial field, a new advertising campaign, comprising data sheets on various applications of electricity, brought a large and interested response. Space was taken at six technical exhibitions, and most of the shooting was completed on a new film on industrial electric heating. A new E.D.A. news-sheet, " Electrified Production," was introduced with a first issue of 30,000 and the favourable reception suggests that it fulfils a real need. The manuscript for the eighth book in the series " Electricity and Productivity " entitled " Process Integration and Instrumentation " was completed.

British participation in the International Union for Electro Heat, previously conducted through a committee of the Institution of Electrical Engineers, was taken over, the E.D.A. providing the secretariat, by a reconstituted committee under the title British National Committee on Electro Heat. Discussions were held on the development of industrial electric heating in the United Kingdom and the committee instigated the preparation of nineteen British papers for the fourth International Congress on Electro Heat being held at Stresa (Italy) this month.

Rural electrification activities included the design and organisation of exhibits at nine shows and exhibitions, and the issue of five new publications. The first two advanced farm electrification courses were attended by 81 students. Other educational and training activities included the 21st annual sales conference, the E.D.A./E.A.W. Housecraft Advisers' Conference and salesmanship training courses. A start was made on the revision of four educational films that are now ten years old. A total of 15,000 loans were made from the Association's film library. Royalties from E.D.A. films distributed in the United States reached $4,312 at the end of the year.

Other activities covered in the report are public lighting, electric traction and public relations. Notes on the work of the Electrical Association for Women and the Electric Vehicle Association of Great Britain are also included. Eight new branches of the E.A.W. were formed. The Association took part in nearly sixty exhibitions and over 1,000 inquiries were made at the Housecraft Department. The number of electric vehicles licensed for road use was double the figure ten years ago.

The report was presented at the annual meeting on Tuesday last; a report of the meeting and the luncheon which preceded it will appear in next week's issue.

Electric Vehicle Association

THE approximate number of battery-electric vehicles in use in Great Britain and Northern Ireland at the end of 1958 was 35,917, as compared with 34,852 in 1957. This is stated in the annual report of the Electric Vehicle Association of Great Britain, presented to the annual general meeting on 7th May. New registrations of battery-electrics during the year totalled 2,293, of which the largest class was the 16 cwt to 1 ton (unladen weight) type, 589; there were 564 in the 1 to 1½ ton class, 409 in the 12 to 16 cwt class and 153 pedestrian-controlled vehicles. Included in the total were 338 vehicles exempt from road fund licence, and 26 invalid vehicles.

The Government's proposals for the testing of all vehicles ten years old or more were the subject of negotiations between E.V.A., users' association and the Ministry of Transport. Arising from these, a deputation led by the E.V.A. president, Sir Wavell Wakefield, M.P., met Mr. G. R. Nugent, the Joint Parliamentary Secretary, Ministry of Transport, and put before him their objections to certain aspects of the proposals, and the necessity for electric battery vehicles to be treated in a different fashion from that of internal combustion engined vehicles. As a result of these representations the Ministry agreed to exclude pedestrian-controlled vehicles from the regulations governing testing, but negotiations continue on the subject of the practical solution for testing driver-seated battery-electrics.

Following upon a visit from a director of the Atlantic City Electric Co., U.S.A., on the subject of the production of battery-electric passenger cars, considerable correspondence developed. Progress reports and information on matters concerning design have been received, and particular interest has been shown in any possible development in the production of an electric car in the United Kingdom.

The report also states that in response to a request from the City Council of Gibraltar Electricity Department, Tomlinson (Electric Vehicles), Ltd., manufactured probably the smallest battery-electric locomotive in the world for use on the Rock of Gibraltar. It is used for the transport of materials from one side of the Rock to the other, and is capable of pulling a 2-ton load at an approximate top speed of 6 miles per hour.

E.R.A. Annual Luncheon

THE annual luncheon of the British Electrical and Allied Industries Research Association (E.R.A.) was held at the Savoy Hotel, London, on 6th May. After the loyal toast had been proposed by the president, Sir Henry Self, a toast to the E.R.A. was proposed by Sir George Thomson, who congratulated the Association on the excellence of the work it had done over a wide range of electrical subjects. There was a most useful interchange of knowledge and information. The rapid advances which were being made in research demanded the maximum co-operation between the people who did the research and those who used the results of it. In the research field, published work seemed to double in quantity every ten years. The growth of knowledge as exemplified by the engineering journals was a real problem and it resulted in most people reading too much. There was no single remedy, but the E.R.A. abstracts were a great help. Many important advances were the results of the linking together of work in different fields. For example, physiology had been completely revolutionised by electronics.

Sir George said that the work of the " populariser," who explained what happened in one field so that it was understandable to workers in other spheres, was becoming as important as that of the people who did the research itself. He would like to see the Royal Society elect one " populariser " each year.

The response was made by Sir Henry Self, who said that the twentieth century was seeing the coming of age of the scientific revolution. In the electrical industry they looked for inspiration to the E.R.A. which focused all the different strands of effort in the many branches of electrical research. During the past 100 years extraordinary progress had been made and the scientist must help the lay mind to understand what he was talking about. Referring to finance, Sir Henry said that if industry wanted the job done it must pay for it but it was essential for small firms to help to sponsor the research which they could not possibly finance or undertake on their own.

Mr. O. W. Humphreys, chairman of the Council of the E.R.A., then proposed a toast to the president, who, he said, believed wholeheartedly in co-operative research. The E.R.A. was created many years ago but its potentialities had not always been fully appreciated. Knowledge and resources must be pooled if the maximum benefits were to be obtained. Mr. Humphreys referred to the need for a thorough reorganisation of the structure of the E.R.A. to find the proper level in the programme. They were now nearly at the stage when some firm proposals could be announced.

VIEWS on the NEWS

By REFLECTOR

IN his *Panorama* (B.B.C. television) programme last week Richard Dimbleby introduced the perennial plug problem. He had managed to find about a dozen kinds of plugs of all sizes and gauges and asked Mr. Forbes Jackson for his views. Mr. Jackson said he knew that the situation had been pretty bad but thought that the 13 A standard plug and socket had settled the problem—at least for new houses. When Mr. Dimbleby displayed a really remarkable array of plugs stuck into a multi-way adaptor, Mr. Jackson agreed that inadequacy of outlets was far too common. What was needed was a ring main which could be tapped anywhere. He advocated persuading builders to provide more sockets in their houses. Mr. G. Nabarro, M.P., the other party in the discussion, referred to the Building (Scotland) Act which gives power to Scottish building authorities to enforce the observance of certain standards laid down by the Secretary of State for Scotland (including lighting, heating and other services). Such a measure should be extended to England; he was all for compulsion in such an important matter. Mr. Nabarro was probably justified; however desirable voluntary compliance may be it cannot be expected of a large number of speculative builders in their endeavours to save a few shillings here and there.

* * *

Writing to the *Birmingham Post*, a Mr. Patrick R. Evershed contends that electricity is not so much more expensive than coal for heating when everything is taken into consideration. One advantage of electric heating, of course, is that it does not give rise to fumes and dirt, but, says Mr. Evershed, electricity users have to suffer from the soot and grime from non-electric neighbours' coal fires. He therefore suggests that a "chimney tax" should be instituted or that the rateable value of houses should be increased by a small amount for each chimney in use, or reduced if there are no chimneys in use. Besides being just, he implies, this would help to bring the cost of living in all-electric homes down to the same level as in other houses. Very ingenious, and maybe desirable, but it looks like a latter-day window tax to me.

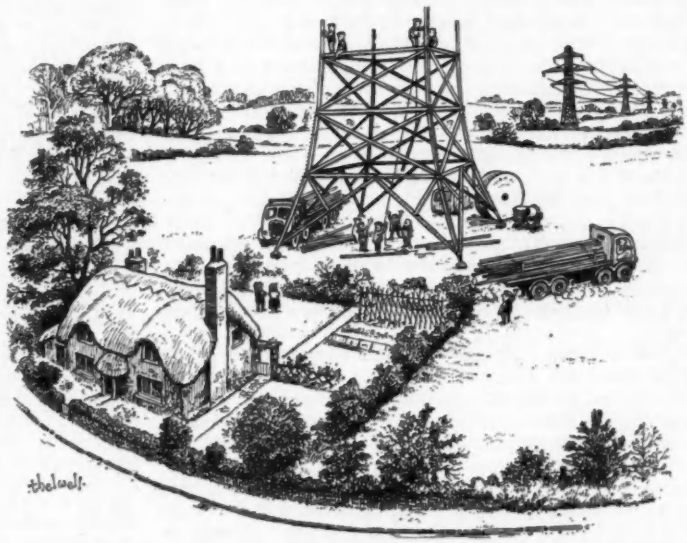
* * *

My readers may remember the rumpus created by the Midlands Electricity Board by its practice of rounding off consumers' accounts when a half-penny was involved by adding a half-penny. Now the South of Scotland Board is being arraigned for a similar practice. But there a real legal point has been raised by one consumer who says that the Board is thus infringing the Weights and Measures Acts. A correspondent says that he has written to the Secretary of State for Scotland accusing the Board of "deliberately giving him short measure to the extent of half a kilowatt a quarter—or in the course of a year sufficient to light a 100 watt lamp for 20 hours." Of course he means half a kilowatt-hour and on this basis his calculation is correct. Nevertheless, I do not expect to see the Board in Court over it.

* * *

Eighty years ago the incandescent filament lamp had not yet secured a hold for electric lighting. Arc lamps of various sorts were still very popular and, according to the *Electrical Review* of 15th May, 1879, electric lighting of this kind had "established itself as a formidable rival to gas." Edison had not "fulfilled the extravagant expectations which his own hasty acts had engendered in the public mind." Nevertheless, in the same issue it was reported that

> "Mr. Edison declares that he has now made his electric light one-third the cost of gas. The Menlo Park machine shop is now regularly lit by 16 lamps, each giving a light equal to three gas jets. The lamp consists of a platinum coil in a glass bulb, about the size of an orange, and will cost about five shillings. The regulator is only required for turning up the light. He has, now, he says, contrived a machine which gives more electricity to the horse-power than either the Wallace or Gramme machines; and hopes to light up all the houses in Menlo Park in a few weeks. His new 2½ horse-power machine feeds five Wallace-Farmer lamps."



"You're wasting your time. We're having no electricity in this house." (Reproduced by permission of "Punch")

I.E.E. Annual Report

THE report of the Council of the Institution of Electrical Engineers for the year ended 31st March last, presented at the 87th annual general meeting last night, shows that the total membership now exceeds 44,000 of whom nearly 2,400 are corporate members. The steady rate of increase in membership over the last few years has been well maintained although the number of proposals received during the year was rather less than the record figure achieved during 1957-58.

The Council has completed an examination of the by-laws, and a number of desirable revisions were submitted for approval to a special general meeting of corporate members held on 9th April. With the exception of the changes proposed in entrance fees and annual subscriptions, the Council's recommendations were unanimously approved, subject to certain drafting improvements. A further special general meeting will be required to consider proposed increases in entrance fees and subscriptions, and supporting financial and other details will accompany the notice calling this meeting.

Meetings held in London and at local centres numbered 1,419, an increase of twelve compared with 1957-58. Ten ordinary meetings were held in London with an average attendance of 252. The following statement shows the membership of the specialised sections, the number of meetings that have been held and the average attendances:

Section	Membership at 31st March, 1959	Number of meetings	Average attendance (figures for previous year in brackets)
Electronics and Communications ...	5,974	50	177 (237)
Measurement and Control ...	3,182	20	148 (92)
Supply	5,439	9	141 (115)
Utilisation	4,813	8	126 (115)

During the year 343 meetings of a general character were held by the ten local centres, eleven sub-centres and eleven specialised groups. The committees of the 19 Graduate and Student Sections have continued their efforts to attract more members to their meetings, visits and social functions, and several are now achieving more satisfactory attendance figures. A conference of hon. secretaries of Graduate and Student Sections was held in November and the suggestions made are being considered, with other matters, by the Committee on Graduate and Student Section Activities.

Phase one of the reconstruction scheme for the Institution building was commenced last autumn and as the economic situation had improved it was decided to go ahead and complete the second and third phases as quickly as possible. In the meantime a new lease has been negotiated with the Duchy of Lancaster which ensures security of tenure for a period of 99 years from March, 1959.

The Council, through the Education and Training Committee, has been concerned with the rationalisation of courses leading to the Higher National Certificate and Higher National Diploma in Electrical Engineering. Further consideration was given to education and training of student apprentices in electrical engineering with particular reference to the increase which is taking place in industry-based sandwich diploma courses. The advisory service on education and training continues to provide answers to inquiries regarding careers in electrical engineering.

There has been a marked increase during the year in the organisation of conventions and symposia for the presentation and discussion of new electrical developments of special significance. Four meetings of this nature have so far been held this year and arrangements for another are in hand for May. The Council has decided that this type of meeting should be financially self-supporting. The change in the title of the Radio and Telecommunication Section to Electronics and Communications Section in February last recognised the growing importance of electronics as an integral part of electrical engineering and defines more accurately the scope of the Section.

The attendance of the President (Mr. T. E. Goldup) and the secretary at the Conference of Commonwealth Engineering Institutions in Australia in March, 1958, and at the Eusec Conference held in New York in April/May, 1958, were the highlights of a world tour in the course of which they were able to form or renew contacts with members of many of the overseas branches of the Institution.

The Institution has played an important part in supporting the new College of Engineering and Technology in New Delhi, for which plans have been drawn up by the Government of India in consultation with the British Government and representatives of the British engineering industry.

Power Supply in Malaya

DIFFICULTIES in the tin mining industry—under the International Tin Agreement output was drastically cut last year—had a major influence on power supply in Malaya in the period covered by the latest report of the Central Electricity Board. More than half the electricity generated in the Federation is used in tin mining and as a result of the recession electricity sales fell from 963·9 million kWh in 1956-57 to 897·6 million last year. As far as the C.E.B. was concerned, however, the effect was masked by the first full year's operation of a group of dredges in the Rawang district and by exceptional increases in sales to other industries. The net result was that the Board's sales rose by 15·6 per cent to 459 million kWh, only a slight reduction on the previous rate of expansion.

During the year the Planning Department concentrated its main effort on the Cameron Highlands hydro-electric scheme, the financial arrangements for which were successfully concluded. For this project, the headwaters of two rivers flowing to the east coast will be diverted, through tunnels, into the valley of the Batang Padang river on the west of the main mountain range, the combined flow being impounded by a dam approximately 120ft high and 450ft long to form a small storage reservoir. The main power station (Jor) will have an initial installation of three 25 MW sets, with provision for a fourth, and just upstream of the storage reservoir there will be an intermediate station (Habu) with a capacity of 4·3 MW. Upstream of this the Board is already constructing a 900 kW station at Robinson Falls which will be interconnected with the Cameron Highlands station.

The first two 10 MW sets were installed at the new Malacca steam station and the Board authorised the placing of orders for the third set and boiler and the extension of the power station structure. Associated with this, work was started on the expansion of the 66 kV transmission system linking the Malacca, Connaught Bridge and Bungsar stations. Survey work was carried out for the proposed 132 kV transmission system in connection with the Cameron Highlands scheme.

The Board's accounts show that income from the sale of electricity rose from $37·3 million to $42·3 million and after meeting all charges there was a balance of $9·8 million, against $8·3 million in 1956-57. (Malayan dollar=2s 4d.)

ELASTOMER RESEARCH AND TESTING

NEW DU PONT LABORATORY

Exterior of the new elastomer research laboratory at Hemel Hempstead

THREE years ago E. I. Du Pont de Nemours & Co., of Wilmington, Delaware, U.S.A., formed the Du Pont Co. (United Kingdom), Ltd., to look after and extend its business in this country which, so far, has consisted of marketing materials imported from the United States. Soon after the British company's formation it acquired a 380-acre site near Londonderry, Northern Ireland, for Du Pont's first full-scale "Neoprene" synthetic rubber plant outside the United States. This is expected to commence operations next year. In the meantime a research and testing laboratory has been completed at Hemel Hempstead, Herts, which will work in conjunction with the new factory, and last week we took part in a Press visit to this establishment.

The purpose of the laboratory is two-fold. First, research will be devoted to evolving improved methods of compounding the "elastomers" produced by Du Pont —"Neoprene," "Hypalon" and "Viton"—thus improving the characteristics of products made from these materials. It should be stressed that the Du Pont company produces materials only; it is not a maker of the products employing them. The knowledge gained in the laboratory will be passed on to the manufacturers concerned. The work will also embrace the evaluation of finished products made from the elastomers in order to establish their advantages in terms of performance under actual or simulated service conditions. The results of these investigations will be made available to manufacturers and potential users.

A wire vulcaniser which simulates the curing process used in the wire and cable industry

The company's technically trained sales staff assist customers in securing the best use of the materials and also pass on to the laboratory the special requirements of customers for investigation.

High-Pressure Vulcanising

The laboratory has a floor area of 10,000 sq ft all on one floor. It is divided into three main parts: dry processing, fluid processing and physical testing. One noteworthy piece of equipment in the dry processing department is a high-pressure wire vulcanising unit. This consists of a steam chamber operating at pressures from 100 to 275 p.s.i. and a water chamber for cooling at the same pressures. Before vulcanising, an extrusion machine covers wire samples with "Neoprene" or "Hypalon." The same machine can also be used for extruding lengths of many different sections for a variety of purposes.

Fluid elastomers, such as those based on latex or solutions of rubber, are dealt with in a section equipped with an ultrasonic homogeniser and a high-speed ball mill which processes materials in a tenth of the time taken by conventional machines.

In the physical testing area is a load-measuring apparatus capable of gauging virtually all the physical properties of rubber, including stress and strain characteristics, tear resistance, tensile strength and adhesion. It can operate at between −70 and +550 deg F. In this section there is also a "weatherometer" which can simulate almost any kind of conditions from intermittent rain and high humidity to dry or humid sunshine. It is used to test the weathering of rubbers under accelerated conditions. In the same field, there is a salt-spray cabinet for studying the effects on protective coatings of

Electronic testing equipment capable of determining many physical properties of rubber samples

"Neoprene" and "Hypalon" as used in the shipping and other industries. Similarly, the equipment also includes an ozone cabinet. Other apparatus in this section are a high-voltage tester for determining the breakdown strength of wire and cable insulation, heat-ageing ovens, an R.A.E. freeze tester, and flexing, abrading and hardness machines.

The laboratory contains the usual rubber processing equipment, including steam-heated hydraulic presses for rubber curing, three-roll calenders for coating or producing rubber sheet, and two-roll mills for mixing dry rubber compounds. There is ample space for any extensions which may be needed in the future.

During the visit brief talks on the laboratory and the company's general activities were given by principal officials, including Mr. William H. McCoy, managing director of the British company, Mr. S. W. McCune, general sales manager, and Mr. David H. Conklin, chairman. Mr. Conklin said that it was the parent company's policy to employ the citizens of the countries in which it operated. This applied to the laboratory and to the new Northern Ireland factory. Selected graduates were sent to the United States for training, which occupied about a year, before being appointed to responsible posts in their own country.

The manager of the laboratory is Mr. W. P. Fletcher, B.Sc., F.Inst.P., A.I.R.I., and the technical manager (elastomers) is Mr. H. J. Lanning, B.Sc., A.R.C.S., A.R.I.C.

It may be mentioned in conclusion that the American parent company has formed subsidiaries in Belgium, to establish a paint plant; in Holland, to manufacture "Orlon" acrylic fibre; and in Geneva, to co-ordinate European sales activities.

FRENCH ATOMIC PIONEERS

IT was just a hundred years ago, on 15th May, 1859, that Pierre Curie was born, and the occasion acts as a reminder of the not inconsiderable part played by French scientists, from Becquerel onwards, in pioneering the atomic age. As far back as 1934, Jean Frédéric Joliot and his wife (Irene, the daughter of Pierre and Marie Curie) were successful in producing radioactivity artificially, a basic achievement which brought them the Nobel Prize for Chemistry in the following year. Joliot, with Halban and Kowarski, was able to prove, in 1939, that uranium and thorium could be "burned" to yield energy.

France, at that time, had built up a stock of about ten tons of uranium which, during the war, lay hidden in North Africa and so escaped falling into German hands. Frenchmen had also taken out the first patents (in Switzerland) for a uranium reactor. After the liberation experimental and research work was resumed, but by then, of course, America had taken the lead. The search for uranium ore in France resulted in the discovery of deposits at Limoges and in other places. In Madagascar, a French colony, large quantities of thorium were located. Since it was also planned to develop polonium, the fuel requirements were, and continue to be, sufficient.

Today, France has a plutonium-producing reactor at Marcoule; two more, although also plutonium producers, will generate electricity and act as prototypes for atomic power stations. They are of the Calder Hall type, and the first was put into actual operation about a fortnight ago. By 1965—when the French hydro-electric potentials will have been fully tapped—four other stations will be functioning. Atomic power, from that point onward, should play an increasingly important role in the economy of the country. It has been predicted that in fifteen years' time the capacity of the French nuclear power stations will exceed 7,000 MW—which is approximately half that expected to be developed here.

J. F. Joliot, appointed High Commissioner for Atomic Energy after the war, came to be regarded as France's leading atomic scientist. He died in August of last year, and was given a State funeral. A foreign member of the Royal Society, he received the Hughes Medal in 1947, and gathered many other scientific honours.—R.R.

Enclosed Fuseboards

THE scope of the revised B.S. 214:1959 has been confined to enclosed distribution fuseboards intended for use in electricity distribution systems in which the maximum current in each outgoing circuit does not exceed 200 A and the declared voltage to earth does not exceed 250 V. The Standard deals with service conditions, ratings and types of fuseboards, marking, performance and construction. Tests are included to prove compliance with the standard, and a special appendix lists certain requirements which may be considered necessary in some circumstances and are therefore the subject of agreement between manufacturer and purchaser.

The specification may be used, by agreement, to cover distribution fuseboards for use on a voltage above 440 V a.c. but not above 650 V a.c.—375 V to earth—provided the fuses are certified and the fuseboards are intended for use in a system in which the neutral point is earthed.

Copies of this Standard may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1, price 5s.

GENERATION and DEVELOPMENT

Power Station Efficiencies

Last year a reduction in fuel cost, equivalent to just over £4½ million, resulted from the improved thermal efficiency of the power stations operated by the Central Electricity Generating Board. The overall average thermal efficiency during the twelve months of 1958 was 25·99 per cent as compared with 25·38 per cent for the previous year.

Over one-third of the 84,670 million kWh supplied from these stations in 1958 was provided by the 20 most efficient stations. These stations had an average efficiency of 30·23 per cent, their individual percentages being as follows:—

STATIONS	THERMAL EFFICIENCY, PER CENT
Castle Donington (near Derby)	32·91
Ferrybridge B (near Knottingley)	31·20
Drakelow (near Burton-on-Trent)	30·84
Willington A (near Derby)	30·76
Stourport B (H.P.)	30·31
Meaford B (Stone, Staffs.)	30·22
Wakefield B	30·12
Stourport B (L.P.)	30·09
Tilbury	30·04
Rogerstone (near Newport)	30·03
Marchwood (near Southampton)	30·02
Stella South (near Newcastle-upon-Tyne)	29·99
Portishead B (near Bristol)	29·84
Littlebrook B (Dartford)	29·73
Hams Hall C (near Birmingham)	29·52
Plymouth B	29·46
South Denes (Yarmouth)	29·40
Stella North (near Newcastle-upon-Tyne)	29·30
Dunston B II (near Newcastle-upon-Tyne)	29·08
Ince (near Ellesmere Port)	28·89

Revised Rental Payments for Transmission Towers

Last September it was announced that the National Farmers' Union, the Country Landowners' Association, the Central Electricity Generating Board and the Area Electricity Boards in England and Wales had settled a revised scale of annual payments to the occupiers of agricultural land in respect of compensation for interference with agricultural operations by the steel towers of grid lines. The Electricity Council has now announced that further negotiations have resulted in agreement upon the following revised scale of annual payments, which are in addition to any compensation payments due:—Towers with bases less than 15ft by 15ft, 4s; 15ft by 15ft and over but less than 25ft by 25ft, 7s 6d; and 25ft by 25ft and over, 10s. The new rates will be paid on the next occasion on which rentals are due on or after 30th June.

Domestic Appliance Sales

The accompanying table shows the number of new appliances sold by Area Electricity Boards in England and Wales for the month of March and for the twelve months ended 31st March last, with the percentage changes over corresponding periods of the previous year. Sales by Area Boards, of course, represent only a part of total sales throughout the country.

	Month ended 31st March		Twelve months ended 31st March	
	Total	% change	Total	% change
Cookers	28,374	+38·3	285,527	+24·8
Water Heaters				
Immersion	12,528	+10·5	167,184	+17·6
Storage	4,527	+13·7	52,060	+23·6
Wash Boilers	5,770	−20·2	77,950	− 2·1
Washing Machines	10,008	+89·6	126,337	+76·2
Refrigerators	5,138	+134·1	82,687	+65·5

Boarding House Electricity Charges

It was reported at last Friday's meeting of the Eastern Electricity Consultative Council that the Board had agreed to allow the proprietors of small seasonal boarding houses to change from the commercial to the domestic tariff for the winter months, by giving one month's notice.

OVERSEAS

Supply in Sarawak

Although electrical loads in the British colony of Sarawak are at present small and confined in the main to domestic supplies in scattered settlements, an assessment made last year by the Government-owned Sarawak Electricity Supply Co., Ltd., indicated a rise in maximum demand from 4,000 kW to 10,000 kW by 1966. To meet this development the company expects to incur capital expenditure amounting to $(Malay)13½ million (about £1½ million). Already, in the last five years, consumption has doubled, totalling 11·3 million kWh in 1957-58.

The chief project on which the company is now engaged is the construction of a new power station in the Sungei Priok (Kuching) area which initially will house three 1,350 kW oil engine sets generating at 11 kV. When fully developed, the site will accommodate eight similar sets. An 11 kV ring main will reinforce the existing 6·6 kV network around Kuching. Plans have been made for placing all low voltage mains in Kuching underground at a cost of more than $500,000.

In a review of the accounts for 1957-58 it is stated that during the present development programme the company is being subsidised from Government funds and this position is likely to continue for some time.

Power from Snowy Scheme

The first power from a major generating station of the Snowy Mountains hydro-electric scheme was fed into the New South Wales interconnected electricity system on 23rd April when Mr. H. G. Conde, chairman of the N.S.W. Electricity Commission, switched on the supply at the Yass distribution centre. This substation, the largest in the southern hemisphere, is connected to the Snowy Mountains scheme by a 330 kV line constructed at a cost of £1,500,000 and completed only a few days before the ceremony.

The T1 station is actually the second Snowy station to be built, a 60 MW plant having been in operation at Guthega since 1955. The new station is much larger; at present there are two 80 MW sets and when completed the installed capacity will be 320 MW. It is the first of five power stations to be built on the Tumut River.

Columbia-Kootenay Development

The hydro-electric potential of the Columbia-Kootenay Rivers area in British Columbia is under consideration by the International Joint Commission. The project, costing $1,000 million, would provide for 60 per cent of the power needs of British Columbia and the Pacific North-west of the United States by 1985. It calls for the building of at least eight large dams across the two rivers before the Columbia crosses the border near Trail.

Under the scheme which the engineering board appears to favour there would be a partial diversion of the Kootenay headwaters into the Columbia, with a dam at Copper Creek. Seven other dams would be built. Another scheme calls for backing up the Kootenay into the Columbia from a dam close to the United States border, reversing the flow of the Kootenay from this point. Under a third scheme there would be no diversion and this would eliminate four of the proposed dams.

Atomic Power Authority for Ceylon

Legislation is to be introduced shortly in the Ceylon Parliament to set up an Atomic Energy Authority. It will have seven members appointed by the Prime Minister and will also be empowered to make grants or loans to persons or institutions engaged in research connected with atomic energy.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Rear Admiral K. R. Buckley, M.I.E.E., M.Brit.I.R.E., has been appointed Director of Engineering and Electrical Training and Chief Naval Electrical Officer of the Admiralty.

Rear Admiral Buckley joined the Royal Navy as a cadet in 1918 and as a lieutenant in 1929 became a torpedo specialist at H.M.S. *Vernon*. From 1932 to 1935 he served with the New Zealand Division and afterwards returned to H.M.S. *Vernon* on the instructional staff. In 1940 he was appointed to the cruiser *Galatea* as squadron torpedo officer and transferred to the Electrical Branch three years later. He was promoted captain in 1949, while serving as fleet electrical officer with the Home Fleet. In January, 1951, he took command of H.M.S. *Ariel*, the naval air electrical school, then near Warrington. Afterwards he served, from 1953 to 1954, as Deputy Director (Personnel) in the Naval Electrical Department at the Admiralty. He was appointed in command of H.M.S. *Collingwood*, the naval electrical school at Fareham (Hants), in 1955 and in 1957 became command electrical officer at Portsmouth. In July last year he was promoted Rear Admiral and made Director of the Naval Electrical Department, Admiralty.

Mr. J. C. N. Baillie, chief commercial engineer of the North of Scotland Hydro-Electric Board, has been appointed a vice-president of the Institution of British Agricultural Engineers.

Mr. C. R. Robinson, B.Sc., has been appointed manager of the newly opened Newcastle-on-Tyne field office of Square D, Ltd., at 91, Pilgrim Street (telephone: 25810). Mr. Robinson is one of the original team which founded Square D, Ltd., in this country and he has considerable experience in the field of electrical control gear and its application.

Mr. C. R. Robinson

Dr. W. Steven, superintendent of the Development and Research Department Laboratory of the Mond Nickel Co., Ltd., Birmingham, is being transferred on 1st June to the Development and Research Division of the International Nickel Co., Inc., New York, as director of research. He has also been elected an assistant vice-president of that company. He is succeeded as superintendent of the Development and Research Department Laboratory by **Mr. C. L. J. Bailey,** B.Sc., Ph.D., who has been superintendent of the Platinum Metals Research Laboratory of the Development and Research Department, Acton, since 1955. **Mr. W. Betteridge,** Ph.D., becomes superintendent of the Platinum Metals Research Laboratory, Acton.

Mr. E. L. Head has been appointed sales engineer for Heatrae, Ltd., for the eastern counties area. For the past ten years Mr. Head has been with the Simplex Electric Co., Ltd., latterly as manager of its Norwich branch. He was previously with the London Electricity Board at Wimbledon.

Mr. E. L. Head

Mr. K. J. Cook, O.B.E., M.I.Mech.E., M.I.Loco.E., chief mechanical and electrical engineer, Eastern and North Eastern Regions, Doncaster, British Railways, is retiring on 30th June.

Mr. Cook entered the service of the Great Western Railway in August, 1912, at the Swindon locomotive works. After military service during the 1914-18 war, he entered the chief mechanical engineer's drawing office and subsequently held a number of mechanical engineering appointments. In 1950 he was appointed mechanical and electrical engineer, Western Region, British Railways, and to his present position in 1951. Mr. Cook was president of the Institute of Locomotive Engineers for the year 1955-56.

Bulpitt & Sons, Ltd., announce the appointment of **Mr. W. Franklin,** A.M.I.E.E., as general manager of their rotating electrical machinery division, B.K.B. Electric Motors, Birmingham. Mr. Franklin received his technical education at Smethwick Technical College and joined B.K.B. Electric Motors in 1924. He has successively held positions as designer, production manager and works manager.

Mr. W. M. Tribute, export advertising manager of Hoover, Ltd., has retired after forty years' service. This occasion was marked on 1st May by a dinner at the Dorchester Hotel, London, given in his honour by Mr. S. Roberts, managing director. It was attended by directors, senior executives and those who had worked closely with Mr. Tribute. A badge marking 40 years of service was presented to Mr. Tribute by Mr. S. Roberts, who also presented him with a silver salver from the directors.

Mr. C. T. M. Bagnall, publicity manager of the English Electric Co., Ltd., has been elected chairman of the Publicity and Exhibitions Committee of the British Electrical and Allied Manufacturers' Association for the Session 1959-60, and **Mr. G. M. C. Peacock,** manager, Publicity Department, Babcock & Wilcox, Ltd., has been elected vice-chairman.

The Midlands area final of the **Electrical Industries National Golf Championship** will take place at Edgbaston Golf Club, Birmingham, on 29th June. The hon. competition secretary is Mr. W. Horrocks, 111, Granville Street, Birmingham, 1, from whom entry forms can be obtained. In conjunction with the competition, there will be a prize draw and the hon. promoter is Mr. N. C. Hadley, 39-43, Soho Road, Handsworth, Birmingham, 21, to whom donations of prizes or cash for the purchase of prizes should be sent. After the competition there will be a dinner for competitors and visitors, at which the prizes will be presented and the prize draw will be made.

Mr. H. P. Sale (M.K. Electric, Ltd.) has been appointed to represent the Association of Manufacturers of Electric Wiring Accessories on the Electrical Fair Trading Council. He succeeds **Mr. J. A. C. Kendle.**

Mr. V. J. Jenner, secretary of Harbottle-Leeson, Ltd., wholesale electrical distributors, Portsmouth, has been appointed to the board of directors.

The George Cohen 600 Group, Ltd., announces that **Mr. R. Gavin Orr,** M.C., M.Inst.W., has been appointed managing director of T. C. Jones & Co., Ltd., structural engineers. He succeeds **Mr. I. Levin,** B.Eng., B.Sc., M.I.C.E., M.I.Mech.E., M.I.Struct.E., M.Inst.W., F.R.S.A., who is approaching retiring age. Mr. Levin remains a director of T. C. Jones & Co.

Mr. A. B. Brown, M.I.E.E., has been elected president of the Electrical Society of Glasgow for the ensuing year.

The last meeting of the **A.S.E.E. Golfing Society** was held at West Herts Golf Club, where over thirty members competed for the Brush trophy. The winner was Mr. R. W. Hankinson (Bill Switchgear, Ltd.), the runner-up being Mr. C. J. Penny. The wooden spoon went to Mr. A. G. Smith. The visitors' prize was won by Mr. R. Dolomore, other prizes

going to Mr. E. R. Vine and Mr. R. D. Taylor. The trophy and other prizes were presented by Mr. Taylor. The Society has arranged to hold its ladies' night on 23rd October next at the Café Royal, London. Its next meeting will be at Fulwell Golf Course on 28th May.

Mr. C. O. Farrer, works engineer of the Birtley Works of W. T. Henley's Telegraph Works Co., Ltd., has been appointed plant development engineer of the company in succession to Mr. F. T. Griffiths, who has retired from that position but is being retained by the company for special duties.

Mr. Farrer joined Henley's as an apprentice at Woolwich Works in 1917 and was transferred to the Plant Maintenance Department in 1923. He was appointed plant maintenance engineer of the Woolwich Works in 1942 and works engineer at Birtley in 1947. **Mr. A. R. Hutchinson** has been appointed works engineer at Birtley in succession to Mr. Farrer.

Kelvinator, Ltd., has appointed **Mr. H. Cameron** as executive director of manufacture and he will be responsible for all aspects of manufacture of the company's range of products. Mr. Cameron was previously general works manager of Coldair, Ltd. He joined Belling & Co., Ltd., in 1922, concentrating on what was then the new wet process of vitreous enamelling, and in 1935 joined the Parkinson Stove Co., Ltd., and was subsequently connected with the Vulcan Stove Co., of Exeter. Throughout the war years he controlled the Domestic Appliance Department of H.M.V., producing engineering prototypes for the three Services.

Mr. H. Cameron

Mr. R. Watt, workshop manager at Dunfermline of James Scott & Co. (Electrical Engineers), Ltd., has retired after forty-six years' service with the company, and at a dinner held recently in his honour he received gifts from the directors and fellow workers. Mr. I. Sclar, joint managing director, presided, and others who attended included Mr. A. S. Thomson (co-managing director), Mr. D. Clare and Mr. J. Scott (directors). Mr. W. Scott (outside supervisor) presented Mr. Watt with an electric cooker on behalf of his colleagues, and Mr. Sclar presented him with a refrigerator from the directors.

Mr. H. D. Crofts retired from the Willesden Works of Lancashire Dynamo & Crypto, Ltd., at the end of April after completing forty-nine years' service with the company. To mark the occasion, Mr. D. C. Lorkin, chairman of L.D.C. and Lancashire Dynamo Group managing director, made a series of presentations to Mr. Crofts on behalf of his colleagues and other friends.

Mr. Crofts joined the Crypto Electrical Co., Ltd., forerunner of L.D.C., as an apprentice in 1910 at works then situated in Bermondsey. In 1924 he became a member of the design department, was appointed chief d.c. designer in 1933 and has been chief designer during recent years. His work has been associated particularly with the development of the design of d.c. rotating machinery, including welding generators, rotary transformers, convertors and alternators.

Mr. D. C. Lorkin (left), Lancashire Dynamo Group managing director, making a presentation to Mr. H. D. Crofts on his retirement

Sir Wavell Wakefield, M.P., was reappointed president of the Electric Vehicle Association of Great Britain at the annual meeting on 7th May. Other officials appointed were:—chairman, Mr. E. Powell (Chloride Electrical Storage Co., Ltd.); vice-chairman, Mr. A. P. Goddard (Austin Crompton Parkinson, Ltd.); treasurer, Mr. H. E. M. Bull (S.E.V. (Sales & Service), Ltd.); secretary, Mr. J. I. Bernard (E.D.A.); deputy secretary, Mr. R. D. Reynolds (E.D.A.).

Mr. H. Schofield, C.B.E., B.Sc., Ph.D., A.M.I.C.E., and **Air Commodore (retd.) W. M. Cooper,** C.B.E., M.A., M.I.E.E., M.Brit.I.R.E., have received 1959 Insignia Awards from the City and Guilds Institute.

Mr. N. Rose is the new president of the Dumfries and Galloway Electrical Society.

The Paisley Association of Electrical Engineers has elected **Mr. F. Dunnet** as president for the ensuing year.

Mr. S. H. Lawrence, general manager of Raydex, Ltd., a member of the Falks group, has been appointed to the board of the company. He joined Raydex in 1957 after ten years with J. A. Crabtree & Co., Ltd., and he was previously with the General Electric Co., Ltd., and George Ellison, Ltd.

Mr. S. H. Lawrence

Mr. R. E. Davis has been appointed as sales manager of Petbow, Ltd. During the war he served in the Royal Navy in destroyers, and is now a lieutenant-commander, R.N.R., in the Electrical Branch. He was an efficiency engineer with the G.P.O. after the war until he joined the overseas organisation of British Insulated Callender's Cables, Ltd., in 1951 representing that company in West Africa, Pakistan and South America.

Mr. H. G. Middleton, Rugby district manager of the East Midlands Electricity Board, retired at the end of last month. He was borough electrical engineer at Rugby before nationalisation and before going to Rugby was manager of the Brentwood District Electric Co., Ltd.

Mr. H. B. MacLennan, district commercial engineer, Greenock, was presented with an electric fire by his colleagues on 7th May to mark his retirement after forty-six years' service at Greenock. Mr. T. K. Wood, commercial officer, Clyde Area, South of Scotland Electricity Board, made the presentation.

Mr. A. McMahon, foreman of the switchgear erection shop at the Elizabeth Works, New Cross, of Johnson & Phillips, Ltd., retired recently after fifty-three years' service with the company. To mark the occasion he was presented with a silver mounted leather wallet containing £50 by Mr. W. Glass, chairman of the company, on behalf of the directors.

OBITUARY

Mr. J. O. Twinberrow.—The death occurred on 4th May, at the age of sixty-seven, of Mr. James Oswald Twinberrow, secretary of the Boiler Availability Committee, and formerly for many years manager of the Publicity Department of Babcock & Wilcox, Ltd. Mr. Twinberrow was a member of the Publicity Committee of the British Electrical and Allied Manufacturers' Association from 1945 to 1950, and was its chairman in 1945-46.

Mr. J. Crowther.—The death has occurred of Mr. J. Crowther, who had been a sales engineer with George

Ellison, Ltd., for the past twenty-nine years; he was due to retire in a few weeks' time. Mr. Crowther was mainly concerned with the sales and consultative service for Ellison switchgear in Sussex and Kent. Before joining George Ellison, Ltd., he was a sales engineer with Mather & Platt, Ltd.

Mr. G. Bennett.—The death occurred on 27th April of Mr. Geoffrey Bennett, manager of the Liverpool factories of the Automatic Telephone & Electric Co., Ltd., at his home in West Kirby. Mr. Bennett, who was forty-five, started his career in telecommunications with the British Post Office. He joined A.T.E. in 1945 after leaving the Royal Corps of Signals, in which he held the rank of lieutenant-colonel.

The late Mr. G. Bennett

Mr. Francis George Hargreaves, works director of Aerialite, Ltd., died on 7th May at the age of seventy-two. He was the elder brother of Mr. L. S. Hargreaves, chairman and managing director of the company.

Sir Leonard Browett, K.C.B., C.B., a director of the Industrial and Commercial Finance Corporation and, from 1945 to 1953, director of the National Union of Manufacturers, died on 7th May at the age of seventy-four.

Mr. Ben Wasden, managing director of the Hallamshire Steel Co., Ltd., died on 2nd May at the age of fifty-four. He had been with the company for nearly forty-two years, was appointed to the board in 1947 and had been managing director since 1954.

Mr. A. S. Bamford, who had represented Falk, Stadelmann & Co., Ltd., in the Aberdeen area for the past six years, died suddenly on 25th April.

Mrs. H. M. Sayers.—The death occurred on 5th May, at the age of ninety-four, at Sheepscombe, Stroud, of Mrs. Elizabeth Kate Blount Sayers, widow of Mr. H. M. Sayers, the well-known consultant.

Aircraft Disaster

A DH Dove aircraft belonging to Lec Refrigeration, Ltd., which was making a flying trip over Cardiff in connection with the Ideal Homes Exhibition being held at Sophia Gardens, dived into a main street in Cardiff on Wednesday last week and then burst into flames. The four occupants, all of whom were killed, were Mr. Paul Chambers, the pilot, Mr. Kenneth Woodfield, the company's West of England representative, Mr. Reginald Burchell, a Cardiff refrigeration engineer, and Mr. Ronald Aston, a commercial photographer.

Parliamentary Report

Fears for the future of the coal industry were expressed by Opposition members during the fuel and power debate in the House of Commons. One of the things which worried them most was the change-over from coal to oil in many industries, particularly in power stations and the gas industry.

Sir Ian Horobin, Parliamentary Secretary to the Minister of Power, offered them consolation by stating that it was not intended that any future power stations should be commenced which would burn oil only, and the Paymaster General, Mr. Maudling, said that the consumption of oil in power stations would decline after 1960 whereas the consumption of coal was likely to increase substantially between now and 1965. They were of the opinion that in a competitive world it would be wrong to saddle British industry with a fuel that was not competitive, but it was stressed that fears should not be exaggerated.

Mr. Maudling said that in recent months, for the first time for many years, the cost of coal production had been falling, not rising. With the continuation of rising productivity and the elimination of the very uneconomic mines, they could surely look to an improvement in the competitive position of the coal industry, which should be able to carve out for itself a larger total demand from what would be an expanding market for energy in this country. In the meantime it was important to continue pressing ahead with research and development into all other methods of using coal.

Speaking on the decline in demand for coal, Mr. Robens, who opened the debate for the Opposition, said that it was only on the basis of having a figure at which to aim that the industry could organise itself in a rational way. In organising and planning, it must have the assistance of the Government, because they also had a responsibility for other nationalised industries, which were big users of coal. If, therefore, 200 million tons was about the right figure for our annual production of coal, it must be based upon a complete co-ordination of the requirements of gas and electricity as the main buyers of coal, together with other industries which took substantial amounts.

The remedy for the situation did not mean keeping all oil out. It did not mean not having liquid methane experiments or not making some gas from oil. It did not mean not extending the nuclear programme as fast as we could. What it meant was looking at the whole picture and giving coal the premier place in our fuel policy.

Mr. Shinwell said that when the Labour Government nationalised the mining industry it was intended that one day these three industries, if not integrated, should be closely co-ordinated, not in competition with each other; if one of the industries did not pay its way, the others would, and the business as a consequence would thrive. If the three industries were co-ordinated under one organisation and direction it was at least conceivable that it would be possible to bring about a greater measure of prosperity and security in them.

Sir Albert Braithwaite said if we could not sell coal he would like to see us selling power. Why should somebody else supply 12 million tons of coal to Ireland when a 40 mile cable was all that was required to transmit electricity from Scotland? Surely some arrangement of this nature could be devised to try to bring some life back into the Scottish coalfields by the production of electrical energy and its transmission to Ireland?

Mr. Cronin said the suggestion by the National Union of Mineworkers of some form of tax on fuel oil deserved consideration.

Sir Ian Horobin said consideration had been given to the possibility of a power line to Northern Ireland, but the Government's information was that it could not hold out any hope of the scheme being competitive.

Kent Supergrid Lines

Mr. Deedes asked when an announcement could be expected of the result of the inquiry held last October into the route of power lines between Canterbury and Dungeness. In a written reply, Sir Ian Horobin said the Minister was at present considering the case, and that of the proposed nuclear power station at Dungeness, in consultation with the Minister of Housing. He could not say when a decision would be reached. Answering a written question by Mr. Irvine about whether an opportunity for representations about the proposed route of the overhead lines from the Dungeness station would be given before a decision on the site was made, Sir Ian said the route of the proposed transmission lines from a power station at Dungeness to a substation at Lydd and from this substation to Canterbury had already been the subject of public inquiries. The Minister in reaching his decision would also take full account of the probability that a further transmission line running westwards would be needed.

Slurry-Burning Power Station

Asked if he would make a statement on the proposed siting of another generating station in Fife, Mr. N. Macpherson, Under Secretary, Scottish Office, replied that he understood that the South of Scotland Electricity Board was giving preliminary consideration to the possibility of building a slurry burning station in Fife but no application had yet been submitted for approval.

INDUSTRIAL NEWS

Electrical Engineers' Exhibition

The 1960 Electrical Engineers' Exhibition will be similar to this year's display and there will again be a ballot for stands. The first-floor feature will be marine electrical engineering. This was announced by Mr. R. F. Mathieson, chairman of the Electrical Engineers (A.S.E.E.) Exhibition, Ltd., at the meeting of exhibitors held in London last week.

The organisers had rejected the idea of sectionalising the exhibition, Mr. Mathieson said, because they believed that this was the wish of the majority of the exhibitors. They would, however, consider the suggestion of a questionnaire, and if this was sent out it would include a statement of the pros and cons of sectionalisation. No increase in stand rentals was envisaged for the 1960 exhibition. They had already had applications from thirteen new exhibitors and twenty exhibitors on the first floor had asked for additional space.

At the beginning of the meeting Mr. Mathieson presented a cheque for 400 guineas to Mr. M. R. Neville, chairman of the Welfare Committee of the Electrical Industries Benevolent Association, who said that this brought the amount contributed by the exhibition in the past five years to over £2,000.

A.S.E.E. Conference

Addressing delegates at the annual conference of the Association of Supervising Electrical Engineers, held last week at Folkestone, Mr. J. H. K. Pendry (chairman) suggested that one way of achieving harmony in industry was to encourage workers to become shareholders. In referring to nuclear power development he stressed the need for more research to ensure that they would not send electricity costs soaring.

British Lighting Council

A report by the British Lighting Council on its activities during recent weeks shows that lectures have been given at many centres all over the country to audiences of a widely-varying character. A survey of lighting in Norwich was carried out in order to counter expected accusations of "unjustified extravagance." Regional engineers have been appointed for the Southern and South Eastern Electricity Boards' areas and for the area of the North Eastern Board.

The Council has been instrumental in influencing the decision of the Blackpool Corporation to relight 46 schools (previously reported as 14) with fluorescent lamps. Test experiments on lighting for "clicking" are to be carried out by the Boot and Shoe Research Association and a special effort is to be made by the Council in the North West region to obtain the co-operation of contractors in shop-lighting activities.

English Electric American Bid

Reuter reports that the English Electric Export & Trading Co. has again submitted the lowest tender for turbines for an American hydro-electric project. This time the project is the Big Bend dam on the Missouri in South Dakota. The English Electric tender at $6,467,313 is said to be almost $3 million lower than the nearest American offer. One of the competing American concerns is the Baldwin-Lima-Hamilton Co. which was recently awarded the Arkansas hydro-electric turbine contract although the English Electric had quoted a much lower price.

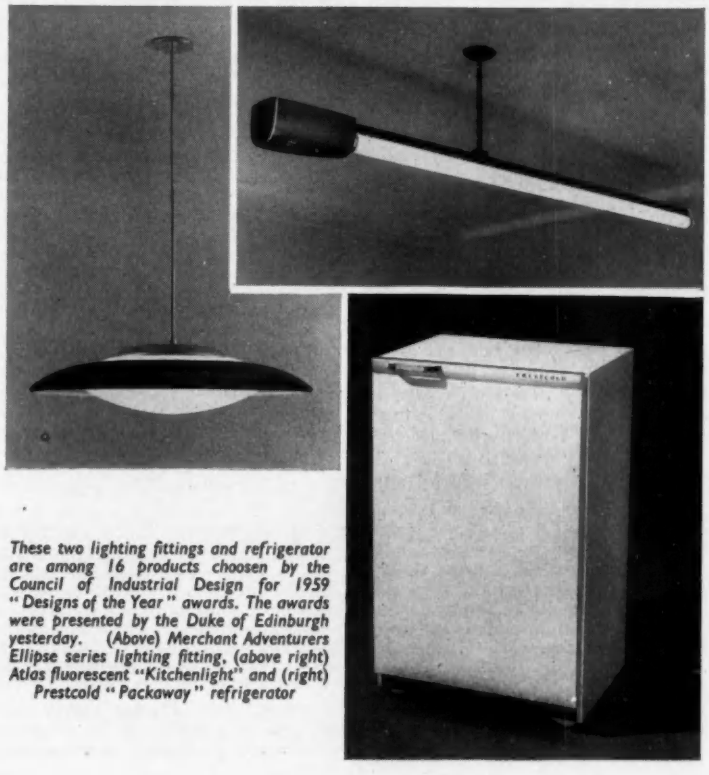
Buried Type Distribution Transformers

The South of Scotland Electricity Board has ordered six buried type distribution transformers from Ferranti, Ltd., for installation in the Clyde Sub-Area. The order covers the supply of five 500 kVA and one 1,000 kVA, 11,000/433-250 V, three-phase units, utilising Class "C" materials.

The idea of these buried type units, made possible by the introduction of Class "C" insulation, was conceived by engineers of the South of Scotland Electricity Board, in co-operation with Ferranti, Ltd., who recently announced (see *Electrical Review*, 21st November, 1958, p. 964) that long-term field trials carried out on one of these units in Scotland had been successful. The main advantage of these units is that they can be installed nearer to a load centre without difficulty, which is in direct contrast to the more conventional solution of reinforcing networks by replacing existing transformers with units of larger rating.

New Cable Repair Ship

Cable & Wireless, Ltd., is inviting tenders for a new cable repair ship capable of handling repairs to telegraph cable and to coaxial cable and rigid repeaters of the type to be used in the Anglo-Canadian telephone cable, to be laid in 1961, and other sections of the proposed round-the-world Commonwealth telephone cable. The new ship will be diesel-electric propelled, with a gross tonnage of about 4,000 tons. The overall length will be approximately 367ft, the breadth about 47½ft and the cable capacity about 21,000 cu ft. The maximum speed will be 15 knots. The ship will be fully air-conditioned to enable her to



These two lighting fittings and refrigerator are among 16 products choosen by the Council of Industrial Design for 1959 "Designs of the Year" awards. The awards were presented by the Duke of Edinburgh yesterday. (Above) Merchant Adventurers Ellipse series lighting fitting, (above right) Atlas fluorescent "Kitchenlight" and (right) Prestcold "Packaway" refrigerator

work in tropical waters, as well as more temperate climates, and will have a sea endurance of about seven weeks. She will thus be bigger and faster than C.S. *Recorder*, at present the largest and fastest vessel in the Cable & Wireless fleet of cableships. The new ship will replace the two smallest ships owned by the company —C.S. *Retriever* and C.S. *Electra*.

Guide to Trade Agreements

The official index to the public files of the Registry of Restrictive Trade Agreements only classifies the agreements by commodities. This limitation is overcome by a new publication, "Who's Who in Trade Agreements," which provides a guide to the parties involved. In the first part of the book the parties named in the agreements are listed alphabetically, with the agreement file number. The second part is a list in numerical order of all agreements appearing in the public register, with details of the parties, commodities, expiry date, etc. The book is to be published annually by G. Rayment & Co., 87, Chancery Lane, London, W.C.2, price 40s, and will be kept up to date by quarterly supplements, price 5s.

Cable Makers' Assurance

In the April issue of their "Cablegram" Johnson & Phillips, Ltd., refer to the ending on 1st May of the pricing arrangements which had hitherto been supported by many of the leading cable makers. This has resulted in a slight reduction in the prices of some types and makes. Johnson & Phillips assure their customers that the quality of their products will be maintained, that technical development will continue and that they will work to "an established Fair Trading Policy for the protection of the legitimate interests of the distributive trade."

Brookhirst Igranic Management

Brookhirst Igranic, Ltd., a member of the Metal Industries group, announces that it is bringing together under one management Brookhirst Switchgear, Ltd., Chester, and the Igranic Electric Co., Ltd., Bedford. The new management has been formed to enable the best use to be made of the facilities of the two companies and Brookhirst Igranic, Ltd., will assume all obligations of Brookhirst Switchgear and Igranic Electric as from 1st June.

Catering Equipment Exhibition

Hoteliers and connoisseurs of good cooking from all over Europe visited the Spring Electrical Catering Exhibition held recently at Torquay. The exhibition was organised by the Torbay District of the South Western Electricity Board, in co-operation with leading manufacturers of equipment. It coincided with the International Gastronomic Festival held at Torquay. On show was a wide range of the latest electrical equipment, specially selected to appeal to the seasonal catering trade where the saving of labour and time at peak periods is a matter of vital importance. Of particular interest was the "Corvette" water heater recently introduced by the Simplex Electric Co., Ltd., which also displayed its "Chef" range with hot-cupboards and other equipment. The G.E.C. exhibited its restaurant catering equipment, a feature of this display being the griddle hotplate which was used in stand demonstrations. Euk, Ltd., staged a representative display including its dishwasher and toaster, and W. M. Still & Sons had on show to the public for the first time its new instant automatic coffee machine. Working demonstration models of the Dishmaster dish washer and Bendix washing machine were among other exhibits and Frigidaire, Ltd., showed deep-freeze and commercial equipment.

New Kenwood Extension Opened

The new office extension to the Kenwood Manufacturing Co.'s premises at Woking were opened by Mr. Harold Watkinson, M.P. for Woking, on 11th May. The extension covers 7,500 sq ft on three floors. The outer wall is aluminium curtain walling, with solid panel infilling in glazed asbestos. It has a precast reinforced concrete frame, and by a new method the erection of the framework was completed in half the normal time. Underfloor electric heating has been installed, and the building is air conditioned. The ground floor is reserved for sales, both in the United Kingdom and export divisions, and the first floor is designed chiefly for senior executives and a board room. The accounts departments are housed on the second floor.

Refrigerating Plant for Russia

The U.D. Engineering Co. has received an order from Russia for further bottling and refrigerating plant valued at over £1 million. About 25,000 h.p. of motors is said to be involved. Compressors will be provided by James Howden & Co. and Crompton Parkinson, Ltd., will be responsible for the engineering and manufacture of the electrical plant.

Furnace Agreement

G.W.B. Furnaces, Ltd., Dudley, has now concluded agreements for co-operative manufacture and sale, in Great Britain and most of the Commonwealth countries, of the whole range of melting plant designed by Demag-Elektrometallurgie, G.m.b.H., of Duisburg, Germany, and by the Lectromelt Furnace Division, McGraw-Edison Company, Pittsburgh, U.S.A. The agreement enables G.W.B. to offer arc furnaces with a capacity of up to 200 tons with or without rotating shell and alternative electrode control systems, these being static or rotating magnetic amplifier types or hydraulic. In addition, the agreement with Demag covers submerged arc furnaces for the reduction of ores and production of ferro-alloys and calcium carbide. The field of induction melting furnaces is also well covered, enabling G.W.B. to offer Demag-designed crucible type units for mains frequency or motor alternator operation for steels, irons and non-ferrous metals. Channel type mains frequency induction furnaces may also be supplied for melting light metals, copper and copper alloys, zinc and iron.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Monday last.

ALUMINIUM ingots	ton £180 0s 0d
COPPER, H.C. Electro	ton £230 15s 0d
Fire Refined 99·70%	ton £229 0s 0d
Fire Refined 99·50%	ton £228 0s 0d
COPPER Tubes ..	lb 2s 3½d
Sheet	ton £262 0s 0d
H.C. wire and strip ..	ton £284 5s 0d
LEAD, English ..	ton £70 10s 0d
Foreign	ton £69 0s 0d
MERCURY	flask £78 0s 0d
TIN, block (English) ..	ton £783 10s 0d
ZINC, G.O.B. Foreign	ton £76 5s 0d
BRASS Tubes (solid drawn)	lb 1s 10½d
Wire	lb 2s 7½d
PHOSPHOR BRONZE Wire	lb 4s 0½d
PLATINUM	oz £28 10s 0d
RUBBER, No. 1 R.S.S. spot	lb 30½d—30½d

Wholesalers Visit Germany

In 1957 it was arranged between the Welmec Corporation, Ltd., London, and its principals, the A.E.G., Germany, that on reaching a certain target they would invite a number of their wholesalers to visit factories in Germany. The visit has now been arranged and fifteen representatives of wholesalers will leave London on 22nd May for an eight-day tour.

I.E.S. Scottish and Newcastle Centres

The Scottish and Newcastle Centres of the Illuminating Engineering Society are holding a joint golden jubilee conference on 29th and 30th May at the Peebles Hotel Hydro. The meeting will commence with luncheon on 29th May and during the meeting two papers will be presented. Dr. W. E. Harper will read a paper on "Advances in Materials for Lighting 1909-1959" and Dr. M. G. Say will give a paper on "Lighting for the Plastics Arts." Social arrangements will include a dinner-dance each evening.

E.T.U. Expenditure Questioned

It is reported that the London Lift and Crane Branch of the Electrical Trades Union has asked the general secretary of the Union, Mr. F. Haxell, to attend a meeting on 28th May to explain the substantial expenditure incurred on entertainment, hotel bills, the expenses of officials and foreign travel. Questions have also been

asked by the branch about the extent of outside Communist influence upon Union policy.

Mr. Haxell, in the course of a reply to the statements made, said that the Union's funds had been expended in strict accordance with the rules of the Union and the instructions of the Executive Council under their powers as set out in the rules.

Transformers for New Zealand

An order valued at £20,000 has been received by the Gresham Transformer Group, Hanworth, Middlesex, from the Ministry of Works, New Zealand Government, for eight 1,667 kVA, single-phase, 33 kV transformers. These will work in two banks and will have on-load and off-load tap changing equipment, as required.

Electronics Exhibition

The third industrial electronics exhibition organised by Farnell Instruments, Ltd., will be held at the Rutherford College of Technology, Newcastle-upon-Tyne, from 26th to 29th May. Most of the leading manufacturers of electronic equipment will be represented and some technical films will be shown in the main lecture theatre.

Lighting for Ghana University

An order valued at £10,000 for 2,100 lighting fittings, for the new Ghana University now being built, has been received by Siemens Edison Swan, Ltd.

The fittings are mostly special types designed in conjunction with the consultants, Oscar Faber & Partners. The majority are opal fittings containing tungsten lamps and fluorescent tube fittings made of aluminium alloy and finished in epoxy resin.

Scottish Electrical Firms Merge

The firm of Richard Smith, 1, Wemyss Place, Edinburgh, electrical contractors, and the firm of Porters, 25-27, Greenside Place, Edinburgh, radio and television dealers, have merged to form Smith & Porter. The premises in Greenside Place have been reconstructed and now include spacious showrooms, an appreciable part of which has been allocated to domestic and industrial heating equipment. There are also a complete electrical installation engineer's workshop and stores and administrative offices.

National Industrial Safety Conference

The largest number of delegates ever to attend a post-war national conference on industrial safety gathered in Scarborough for the National Industrial Safety Conference held from 8th to 10th May, organised by the Royal Society for the Prevention of Accidents.

The conference was opened by Sir George Barnett, a vice-president of the Royal Society for the Prevention of Accidents and a former chief inspector of factories. Sir George described some of the work carried out by the Industrial Safety Division of the Society over the previous year. He made particular reference to work which was now being done to improve the standards of safety training in technical schools and colleges and the steps which private industry was taking to see that the training of their own operatives was carried out with a full understanding of the safety requirements of each individual job. At the conclusion of his address, Sir George presented the Sir George Earle Trophy to this year's winner, Vauxhall Motors, Ltd. Over fifty firms supplying industrial safety equipment exhibited their products in the Corner Café.

Change of Address

The head office of the South of Scotland Electricity Board will be transferred as from 18th May to Inverlair Avenue, Glasgow, S.4 (telephone: Merrylee 7177).

Trade Announcements

The share capital of **C. E. Sleeper, Ltd.**, manufacturers of industrial electrical switchgear, has been acquired by **Grelco, Ltd.** Manufacture will continue at the Glenmore Road Works, Minehead, Somerset, but all orders and correspondence should be sent to C. E. Sleeper, Ltd., Grelco Works, Hopcott, Minehead, Somerset.

Chilton Electric Products, Ltd., announces that the work on its new factory at Hungerford has progressed sufficiently for the offices to be occupied, and the sales office will now be permanently at Hungerford. The London office will now be used only as a service centre. All inquiries should now be addressed to the head office at Hungerford, Berks.

The South West of England area sales organisation of the **Anglo-Swiss Screw Co., Ltd.**, has been extended and the external sales and service representation is now directed through the Bristol office and controlled by Mr. E. McL. Maxwell, Stock Exchange Buildings, St. Nicholas Street, Bristol, 1 (telephone: Bristol 92716/7), who will be assisted by Mr. A. Parker.

The telephone number of **Salvicta, Ltd.**, Forest Gate, E.7, is now Maryland 7962-3-4.

Technograph Printed Circuits, Ltd., and **Technograph Electronic Products, Ltd.**, have moved to Eros House, 29-31, Regent Street, London, S.W.1 (telephone: Regent 5273/5). Incorporated in the new offices is a technical showroom for the display of printed circuits in all forms.

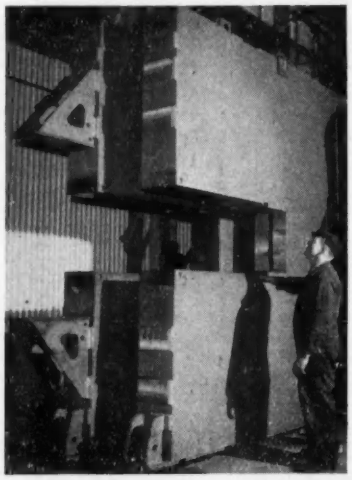
The **Ransomes & Marles Bearing Co., Ltd.**, has opened a branch at 42, London Road, Southampton (telephone: 28871). Mr. G. D. Ball is manager of the new branch.

Price Reductions

With effect from 27th April Philips Electrical, Ltd., has reduced the prices of its TME series of bi-pin batten fittings.

Large Synchrotron Magnet

THE 7,000 ton core of an electromagnet, the biggest in the British Commonwealth and heaviest in Europe outside the U.S.S.R., is now being built by Joseph Sankey & Sons, Ltd., for the National Institute for Research in Nuclear Science.



One of the 336 magnet sectors for the 7 GeV proton synchrotron being built at Harwell

The complete magnet core, which has to be accurate in parts to within 0·005in, will be 160ft in diameter. Because of transport and installation problems, it is being produced in 336 sectors, at the rate of one a day, each sector weighing nearly 20 tons and tapered to one-half of one degree at the rear to ensure a perfect fit. The last sector should be finished in May, 1960.

Each magnet sector stands 10ft 5in high, 9ft 3in wide and 12½in thick and is made from 45 silicon steel plates, each of which has to be flawless, level and completely insulated from its neighbour. The magnet sectors, which cost £1½ million, form the largest component part of the £7 million 7 GeV proton synchrotron, to be known as "Nimrod," which is being built at the Rutherford High Energy Laboratory, Harwell, for the National Institute for Research in Nuclear Science.

The synchrotron, when completed in 1961, will be Britain's most powerful tool for fundamental research in nuclear physics, and is being built by the Institute to provide universities and other institutions with facilities and equipment which are beyond their reach, both financially and physically.

Financial Section

STOCKS and SHARES

SINCE the outcome of the next General Election is regarded as the principal unknown quantity in the near outlook for the industrial sections of the Stock Exchange, the results of the municipal elections helped markets to maintain their good form over the past week. In the electrical market, profit-taking affected some of the shares which have lately risen the most sharply, and gave the price lists a rather irregular appearance. Also, some of the company news produced disappointments. On the whole, however, prices remained firm and a number of new high records were established.

Higher Prices

Shares of the major electrical and nuclear power groups remained comparatively quiet, but prices were a little harder than of late. Some "radio" shares came into prominence, notably E. K. Cole, which rose 2s 3d to 19s 9d, and Decca, with an improvement of 1s in the "A" shares to 34s 3d. Among domestic equipment issues, Burco Dean added 6d to previous gains, reaching 14s 3d, following the declaration of an increased interim dividend. Morphy-Richards improved to 23s 3d, and the rise in Berry's Electric proceeded further to 16s 9d. Other noteworthy changes included gains of 3s 3d, to 45s 9d, in British Thermostat, and of 1s 3d, to 10s 9d, in Rheostatic. S. Smith, with another advance of 9d to 15s 6d, were outstanding in the motor accessory group, and Telephone Rentals, at 15s 3d, continued to reflect satisfaction with the recently reported increase in profits and dividends.

Active Stocks

Shares known to have an active American following reflected some rather sharp swings in Wall Street prices. In the course of another big turnover, Elliott-Automation lost some of the previous week's 5s rise, and E.M.I. were a little lower at 54s 3d. On the other hand, Philips Lamps jumped to £6. Minor reactions from earlier advances affected Vactric, Ward & Goldstone, Walsall Conduits, Hackbridge & Hewittic, Thorn Electrical and some others. In the cable group, B.I.C.C. came back a little to 55s 9d, and Hackbridge Holdings to 16s 3d, but Scottish Cables were supported up to 16s. Dealings began in R. B. Pullin new shares at a premium of about 5s on the price of 7s 3d at which they are offered to shareholders.

Automatic Telephone Results

A fall of more than 20 per cent in the trading profit for 1958, to £1·55 million, is reported by Automatic Telephone & Electric. A much smaller tax charge leaves the net surplus only moderately lower than before, so that a comfortable margin remains for the maintenance of the dividends, in effect, at a total of 17 per cent. (For the ordinary shares the distribution includes 6 per cent in the form of a special interim on account of the current year, which will not affect other dividends for this period.) Following these

Price Changes in

Company or Board	Nom. Value	Middle price 11th May	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1959 Highest	1959 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	78½		3	3	3 16 6	80½	77½
Brit. Elec. 1974/77	100	75½		3	3	3 19 6	77	74½
Brit. Elec. 1976/79	100	79		3½	3½	4 8 6	80½	77½
Brit. Elec. 1974/79	100	89		4½	4½	4 15 6	90½	87½
Overseas Electric Supply								
Calcutta Elec.	£1	19/6		6·8†	7†	12 9 9	19/6	16/-
East African Power	£1	20/-		7½	8	8 0 0	22/3	19/3
Nigerian Elec.	£1	14/6		10	10	13 16 0	15/-	13/9
Perak Hydro-Elec.	£1	14/6	+6d	12½	10	13 16 0	14/6	12/3
Electrical Shares								
Aberdare Holdings	5/-	16/-		17½	17½	5 9 6	16/3	15/6
Aerialite	1/-	8/9		51½	54	6 3 6	9/6	7/9
Allen, W. H.	£1	46/3	+9d	10	11	4 15 3	46/3	43/-
Anglo-Portuguese Tel.	£1	28/3	−6d	8	9	6 7 6	29/3	26/6
Aron Elec. Ord.	£1	57/6		15	15	5 4 3	61/6	57/6
Assoc. Elec. Ord.	£1	61/3	+1/3	15	15	4 18 0	61/3	53/9
Automatic Tel. & El.	£1	76/9	−5/9	17	17‡	4 8 6	82/6	73/9
Babcock & Wilcox	£1	47/3	−9d	13½	13	5 10 3	53/9	45/6
Bakelite	10/-	26/6	−6d	15	15	5 13 3	27/6	22/-
Baldwin, H. J.	2/-	3/-	−6d	20	20	—	3/-	2/3
Berry's Electric	5/-	16/9	+9d	10	10	2 19 9	16/9	10/9
Bowthorpe Holdings	2/-	15/3		37½	25*	3 5 6	15/6	11/9
British Elec. Traction: Def. Ord. "A"	5/-	38/6	−1/-	25	25	3 5 0	40/-	35/6
B.I. Callender's	£1	55/9	−6d	12½	13½	4 16 9	56/6	44/9
B.I. Callender's 6% Pref.	£1	20/-		6	6	6 0 0	20/6	19/9
British Thermostat	5/-	45/9	+3/3	25	30	3 5 6	45/9	37/-
British Vac. Cleaner	5/-	7/9		10	7½*	4 16 9	7/9	4/6
Brook Motors	10/-	50/-	−4/3	25	24½*	4 16 6	54/3	46/-
Bulgin, A. F.	1/-	9/-	+3d	45	50	5 11 3	9/3	6/9
Bulpitts	5/-	14/3	+6d	—	15	5 5 3	14/3	10/-
Burco Dean	5/-	14/3	+6d	22½	16*	5 12 3	14/3	12/3
Cable & Wireless: Ord.	5/-	15/-	+3d	10	10*	3 6 9	15/-	12/3
4% Loan	100	94½		4	4	4 4 9	95	93
Chloride El. Storage "A"	£1	78/-		17½	20‡	5 1 6	79/6	65/6
Clarke Chapman	£1	55/9		27½	13¾*	4 18 9	66/3	55/9
Cole, E. K.	5/-	19/9	+2/3	17½	17½	4 8 6	21/3	17/3
Contactor Switchgear	5/-	14/-		20	14*	5 0 0	14/-	12/-
Cossor, A. C.	5/-	8/6	+3d	2½	Nil	Nil	9/-	6/3
Crabtree	10/-	31/3	+6d	20	20	6 8 0	31/6	28/-
Crompton Parkinson	5/-	14/3		16	12*	4 4 3	14/3	11/9
Davis & Timmins	5/-	15/-		18	20	6 13 3	15/3	14/6
De La Rue	10/-	35/6		35	17½*	4 18 6	35/6	30/3
Decca "A"	10/-	34/3	+1/-	43½	50	5 16 9*	40/3	33/3
Desoutter	5/-	26/6		32½	21⅜*‡	4 1 6	26/9	19/-
Dewhurst	2/-	7/6		20	20	5 6 9	8/3	7/3
Dictograph Tel.	2/-	8/3		20	20	4 17 0	8/3	7/-
Dubilier Condenser	1/-	4/6		30	20*	4 9 0	4/6	3/3
Duport	5/-	12/-	+3d	25	12½*	5 4 3	12/-	10/3
E.M.I.	10/-	54/3	−9d	15	20*‡	3 13 9	64/6	50/-
Electrical Apparatus	5/-	13/6		12½	14½	5 2 6	14/-	13/-
Electrical Components	5/-	14/3		12½	12½	4 7 9	14/3	10/6
Elec. Construction	£1	31/6		8½	8½	5 8 0	31/6	27/9
Elliott-Automation	5/-	27/6	+1/3	—	10	1 16 3	30/6	16/9
Enfield Cable Ord.	£1	20/3	−6d	2½	Nil	—	22/3	16/3
English Electric	£1	63/9		14	14	4 7 9	65/6	56/9
English Electric 3½% Pref.	£1	12/6		3½	3½	6 0 0	12/9	12/3
Ericsson Tel.	5/-	23/6	+3d	12†	13†	4 16 0	27/3	23/3
Ever Ready	5/-	28/-		37½	20*	3 11 6	28/-	22/-
Falk Stadelmann	£1	28/-		17½	10*‡	7 2 9	32/9	26/3

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

results the price of the £1 ordinary shares was marked down initially from 82s 6d to 73s 9d, but partially recovered later to 76s 9d. A half-yearly statement from Brook Motors also disappointed expectations and was followed by a reduction of 4s 3d in the price of the 10s shares to 50s. The interim dividend is being repeated at 5 per cent on increased capital, but the group trading profit, before tax, for the six months ended last March, was some £243,000 lower than the £561,000 earned in the corresponding half of 1957–58.

Electrical Investments

Company or Board	Nom. Value	Middle price 11th May	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1959 Highest	1959 Lowest
Electrical Shares—continued								
G.E.C.	£1	32/6	+6d	12½	10	6 3 0	40/3	31/3
G.E.C. 6½% Pref.	£1	20/6	−6d	6½	6½	6 6 9	21/6	20/3
General Cables	5/-	9/3	+6d	24	15	8 2 3	9/3	7/6
Greenwood & Batley	£1	84/-	+1/-	17½	20	4 15 3	84/-	75/-
Hackbridge Holdings	5/-	16/3	−6d	20	20	6 3 0	16/9	14/3
Hackbridge & Hewittic	5/-	14/6	−1/9	20	20	6 18 0	16/3	13/9
Head Wrightson	5/-	26/3		22½	17½*	3 6 9	28/6	24/3
Heatrae	2/-	9/-		15	20	4 9 0	9/-	7/6
Holophane	5/-	15/6		37½	22½*	7 5 3	16/6	15/6
Hoover	5/-	66/6	+6d	50	60	4 10 3	66/6	55/-
I.C.I.	£1	34/6		12	8*	4 12 9	38/3	33/-
Intl. Combustion	5/-	36/6		25	30‡	4 2 3	36/6	29/9
Intl. Computers & T.	£1	72/-	−6d	—	8‡	2 4 6	72/6	57/6
Johnson & Phillips	£1	27/6		10	5	3 12 9	30/6	22/-
Lancashire Dynamo	£1	57/6		11	12½‡	4 7 0	57/6	42/-
Laurence Scott	5/-	17/3		15	15	4 7 0	17/9	16/6
Lister, R. A.	£1	40/-	+9d	10	12½	6 5 0	41/-	32/9
Lucas, J.	£1	50/-		7½	10‡	4 0 0	50/-	43/3
Marconi Marine	£1	40/-		10	10	5 0 0	48/6	40/-
Marryat & Scott	2/-	9/6		35	37½	3 19 0*	9/6	8/6
Mather & Platt	£1	45/-	−2/-	15	10‡*	4 12 0	51/6	41/3
Metal Industries	£1	47/6		9	14	5 18 0	47/6	39/9
Midland Elec. Mfg.	£1	44/6		12½	10*	4 10 0	45/-	41/6
Morphy-Richards	4/-	23/3	+9d	20	20	3 8 9	23/3	18/-
Murex	£1	46/6	−1/-	20	17½	7 10 6	49/6	42/-
Newman Ind.	2/-	2/9		10	10	7 5 6	2/9	2/3
Oldham & Son	1/-	3/-		17½	17½	5 16 9	3/-	2/6
Parsons, C. A.	£1	46/6	+6d	7½	8½‡	3 10 0	55/9	46/-
Philips' Lamps	Fl.10	120/-	+7/6	14	14	2 4 0	121/6	88/-
Plessey	10/-	91/-	−1/-	30	30	3 6 0	92/-	70/6
Pye	5/-	15/3	+6d	12½	12½	4 2 0	16/9	13/9
Pyrotenax	5/-	35/6		—	27½‡	3 17 6	38/3	33/9
Reliance Clifton	5/-	19/3		13½	15	3 18 0	19/9	17/6
Reyrolle	£1	85/9	−6d	17½	17½	4 1 6	98/-	85/9
Rheostatic	4/-	10/9	+1/3	12½	12½	4 13 0	10/9	8/3
Richardsons Westgarth	10/-	13/9		16¾	8½*	6 1 3	15/3	13/9
Scottish Cables	4/-	16/-	+1/3	27½	27½	4 0 0*	16/3	13/3
Simon-Carves	5/-	30/6	−9d	25	25	4 2 0	32/-	28/6
Smith (England), S.	4/-	15/6	+9d	20	12½*‡	3 4 6	15/6	11/6
Southern Areas	£1	13/9	+9d	7½	Nil	Nil	14/9	10/6
Strand Elec.	5/-	10/3		15	15	7 6 3	10/3	8/6
Sturtevant	5/-	20/-	+1/6	15†	15†	6 10 6	20/-	17/-
Sun Elec.	£1	80/6		25	25	6 4 3	80/-	66/-
Swjtchgear & Cowans	5/-	12/3		22½	15*	6 2 6	13/-	10/3
Taylor Tunnicliff	5/-	21/9		17½	17½	4 0 6	26/-	18/-
T.C.C.	10/-	43/9		25	25	5 14 3	43/9	38/-
Telephone Mfg.	5/-	5/9		10	10	8 14 0	5/9	4/9
Telephone Rentals	5/-	15/3	+1/-	12½	12½*	4 2 0	15/3	11/9
Thompson (John)	5/-	24/6		25	25	5 2 0	25/6	22/9
Thorn Elec.	5/-	35/-	−2/-	17½	17½	2 10 0	38/6	26/3
Thornycroft	£1	25/9		12½	7½	5 16 6	25/9	20/6
Tube Investments	£1	85/9	+9d	15	17½	4 1 6	85/9	71/6
Vactric	5/-	37/6	−2/6	25	25	3 6 9	44/6	26/3
Veritys	5/-	2/6		12½	2½	—	5/-	1/3
Walsall Conduits	4/-	21/3	−1/-	20	22½	4 4 9	22/3	16/9
Ward & Goldstone	5/-	41/-	−1/-	40	25*	3 1 0	42/-	30/6
Watford	2/-	8/9	−3d	25	25*	5 14 3	9/-	7/6
Westinghouse	£1	43/9		10	10	4 11 6	47/-	39/6
West, Allen	5/-	12/6	−3d	12½	11‖*	4 13 3	14/-	11/9
Wolf Electric	5/-	8/-	+3d	10	10	6 5 0	8/6	7/9

Sangamo Weston Issue

The 10s ordinary shares of Sangamo Weston are now quoted ex the one-for-three scrip issue and stand at about 19s, with the new shares a few pence higher. Shareholders have been advised not to regard this distribution as implying any increase in the amount of the dividend. Last year, turnover was raised slightly but the effect of higher production costs on profit margins caused a reduction in trading profits. In the current year, competition is said in the company's report to be growing even keener, and until demand for the products expands far enough to employ the modernised works at or near their full capacity, no improvement in profits is to be expected. For the past four years the company has paid dividends of 12½ per cent. The corresponding rate on the enlarged capital of £945,000 would be 9½ per cent, on which basis the shares yield a fraction under 5 per cent.

Babcock & Wilcox Prospect

In his review accompanying the annual report of Babcock & Wilcox, Mr. Lionel Fraser is firmly confident that the group's careful planning, skill and experience will in the course of time bring their reward, but he does not encourage hopes of improved earnings in the early future. Business may in fact prove less profitable and less plentiful. Factors contributing to the contraction of more than 25 per cent in last year's net group profit included the curtailment of the Central Electricity Generating Board's plans and the increasing size of boilers, of which the chairman says a year's programme may nowadays require perhaps only a quarter the number used a few years ago. The company's £1 shares have remained on the dull side at 47s 3d and offer a yield of 5½ per cent on the 13 per cent dividend, which is covered more than 2½ times by last year's earnings.

Company Meetings

At the annual meeting of Aberdare Holdings, held earlier this month, the chairman reported that during the previous six months turnover had been well maintained, and although he was rather less confident about the second half of the current year he had every hope that the company would retain its share of the business placed. The dividend has been kept at 15 per cent for five successive years, and is covered more than twice by the improved profits of 1957–58. At 16s the 5s shares yield approximately 5½ per cent. Switchgear & Cowans were said at the annual meeting to have a very satisfactory order book. With the capacity for raising production from the present factories nearing its limit, the development of a new site would probably have to be started this year.

REPORTS and DIVIDENDS

Babcock & Wilcox, Ltd.—The main figures in the accounts for 1958 were given in our issue of 1st May. In his statement, which has been circulated with the report and accounts, Mr. W. L. Fraser (chairman) says there is no need to emphasise that during the past year the engineering industry experienced arduous and testing trading conditions, as this is well known. In the company's case there was some improvement towards the end of the period.

At the beginning of last year heavy engineering had to bear a major share of the setback in general industrial expansion. The boilermaking industry's outlook was, however, affected even more by the curtailment of the C.E.G.B.'s plans for installing conventional power plant. In addition, rapid technological development has enabled the total steam capacity required for a given electrical output to be reduced substantially, and boilers are now built as much larger units. As far as size is concerned, the advance has been phenomenal, so much so that, taking all the factors into account, the total number of boilers likely to be needed for a year's programme of the C.E.G.B. is possibly, by comparison, only one-quarter of the number ordered a few years ago. If this pattern endures, as seems likely at any rate for two or three years, it cannot fail to have adverse repercussions throughout the industry. The trend towards bigger units was one of the main reasons for their taking a particular interest in the facilities of the Royal Ordnance Factory at Dalmuir. It had been apparent for some time that amongst the urgent requirements at the Renfrew Works were additional shops having bays of wide span, great height and with heavy crane installations for the production of large welded drums and vessels, as well as for the assembly and testing of heavy cranes. In addition, they had in prospect the fabrication of large vessels and equipment for Hinkley Point power station. These needs have been completely met at Dalmuir, and there are other valuable facilities complementary to those at Renfrew, which will enable the company to develop ranges of engineering products not previously manufactured. Arrangements for acquiring the lease of the Dalmuir Works were concluded during 1958, and shortly afterwards they commenced production in some sections. On 1st January last complete possession of the premises was obtained.

Many difficulties have had to be overcome in the construction of the Hinkley Point nuclear power station in Somerset, but, despite these, considerable progress has been made. In addition, they have been active, in partnership with the English Electric Co., Ltd., and Taylor, Woodrow, Ltd., in formulating designs for the installation of atomic power stations abroad. Babcock & Wilcox are also participating in nuclear designs for marine propulsion.

Owing to the state of the home market, orders in overseas markets have become more vital than ever, and the proportion of work undertaken for export has been at a high level. Important installations in New Zealand, Trinidad, Iraq and Nigeria are under construction by the parent company. At the same time the companies in Australia and Africa are engaged upon the construction of steam plant for large generating stations, both for local electricity authorities and for industrial users.

In Brazil and Mexico the companies are gradually establishing themselves. In their turn, the Babcock companies associated with them on the Continent of Europe, as well as their licensees in Europe and the Far East, are playing an energetic part in meeting the demands for power in their respective spheres. It must be admitted, however, that British technical efficiency is frequently being matched by standards attained by competitors in Europe, and the markets of the world are thus the scene of increasing competition.

After referring to the activities of the various companies in the group, Mr. Fraser, in dealing with prospects, says that for a period business may prove to be less profitable and even less plentiful. Despite these possibilities, he is of the opinion that over the years ahead the carefully planned preparations will bring their reward.

Vickers, Ltd.—With its report and accounts for 1958, Vickers, Ltd., has issued an illustrated review of the group's activities. Reference is made to the placing of a contract with the Metropolitan-Cammell Carriage & Wagon Co., Ltd., by the London Transport Executive for 532 tube cars for the Piccadilly Line. The value of the contract is £5½ million. Ioco, Ltd., secured valuable business in the field of electrical insulation for Admiralty cables and in meeting the ever-increasing demands from manufacturers of heavy rotating electrical machinery for improved flexible and rigid insulations. Throughout the year Vickers Nuclear Engineering, Ltd., had continued to co-ordinate the work on two important naval projects. The first was the building of a land-based prototype set of nuclear submarine machinery at Dounreay. The second was the preparation for the building of the submarine *Dreadnought* at Barrow utilising a propulsion unit supplied by the United States through the agency of Rolls-Royce. Both these projects are being carried out in association with Rolls-Royce, Ltd., and Foster Wheeler, Ltd. A new subsidiary of Rolls-Royce has been formed of which Vickers and Foster Wheeler are associates. Its first objective is the design and development of pressurised water reactors for naval purposes.

A number of new products were brought to an advanced state of development at the Vickers Group research establishment. Examples include linear electron accelerators, electrical servo-mechanisms, a 100 MeV sub-unit of a multi-BeV linear electron accelerator and a high peak klystron amplifier.

Sturtevant Engineering Co., Ltd.—The annual meeting was held on 8th May, Mr. H. W. Wagner (chairman) presiding. In his review of the year, which had been previously circulated, the chairman said that they started 1958 with a reasonably satisfactory list of orders, some of which were placed in the later part of 1957, but many of these had to be accepted with a lower profit margin than in former years, due to intensified competition, and this was reflected in the profits.

The reduction in the number of coal-fired power stations now being built in the United Kingdom was bound to affect the volume of orders received by the Electrostatic Precipitation Department, but every effort was being made to compensate for this by obtaining contracts from overseas and also to open new fields at home for this equipment. The Australian company had been busy and the agreements extending their interests in Canada, mentioned in last year's report, had been completed.

So far this year there were signs that the volume of orders for some departments was increasing, but there was no concrete evidence as yet of still further improvement. In former years they were handicapped by the lack of production facilities, but this had now, to a great extent, been rectified and should the number of orders increase they would be able to accept them with a much shorter and more reasonable period of delivery than before.

The Birmingham Sound Reproducers, Ltd., group, which makes record changers, is to enter the refrigeration field. This is stated by Mr. D. M. McDonald in his annual statement, in which he says that plans are in hand for extending factory space, and production of sealed compressor units for refrigeration equipment will begin as soon as possible.

Taylor, Woodrow, Ltd.—In his review of 1958, which has been circulated to shareholders, Mr. F. Taylor (chairman and managing director) refers to construction work on nuclear power stations, on which the company is engaged in association with the English Electric Co., Ltd., and Babcock & Wilcox, Ltd. He says that the Hinkley Point power station continues to attract the widest interest, not only owing to its size and importance, but also because of the vigorous manner in which the contract is being under-

taken. During 1958 the second atomic power station at Calder Hall and the conventional station at Castle Donington were both successfully commissioned. The work upon other power stations at High Marnham and Northfleet is progressing well.

Automatic Telephone & Electric Co., Ltd.—The group profits for 1958 amounted to £1,554,139, as compared with £1,981,905 for 1957. After deducting £476,335 for United Kingdom taxation and £54,260 for overseas taxation, and crediting £4,964 overprovided, the net balance is £1,028,508 (against £1,139,144). It is proposed to pay a final ordinary dividend of 6 per cent, making 11 per cent for the year on capital of £3,440,000 (against 17 per cent including 5 per cent paid on capital of £2,584,400), plus a special interim dividend of 6 per cent for the current year which will not be taken into account in considering payment of other dividends for 1959. The deferred capital also receives 11 per cent for the year, plus the 6 per cent special interim dividend.

Wolf Electric Tools (Holdings), Ltd.—The annual meeting was held on 6th May, Mr. H. Richards (chairman) presiding. In his statement, which had been previously circulated, the chairman said that the difficult trading conditions resulted in a decline in their income and the profit margin had been reduced. In particular, overseas sales were influenced by further import restrictions in certain of their traditional markets and by the added competition experienced elsewhere; the Australian subsidiary experienced an especially difficult year. To maintain exports, it was now essential to allow extended credit terms in many markets.

The Canadian branch recorded the highest sales in its history, and had since moved to more spacious premises. A new company had been formed in India in conjunction with their associates there, Rallis India, Ltd. Factory premises were now under construction for the partial manufacture and assembly of a range of Wolf tools.

On the technical side they introduced last autumn the first British-made double-insulated power unit, which was also the first produced anywhere for domestic use. There had been some improvement in the first quarter of the year as compared with the corresponding period of 1958, and there were indications that, with their existing plans and changes in organisation, this improvement could at least be maintained.

Telephone Rentals, Ltd.—After providing £414,478 for taxation, the group net profit for 1958 is £682,422, as compared with £487,176 for 1957, of which £678,521 is attributable to the holding company. General reserve receives £250,000 and tax equalisation reserve is increased by £173,250. It is proposed to pay a final dividend of 7½ per cent on capital increased by a one-for-five scrip issue, maintaining the distribution for the year at 12½ per cent.

Brook Motors, Ltd., in an interim report states that the group profit for the six months to 31st March last was £317,834, as compared with £561,390 for the corresponding period of the previous year. Depreciation absorbs £56,912 and taxation £118,599, leaving a net balance of £142,323 (against £243,642). An interim dividend of 5 per cent (unchanged) is announced on capital increased by a one-for-five scrip issue.

The Power Securities Corporation, Ltd., reports that after providing £261,517 for taxation, the group net profit for 1958 is £525,452, as compared with £373,948 for the preceding year. The dividend for the year is maintained at 11 per cent. The 250,000 new £1 shares issued last October rank for only part of the dividend.

Increases of Capital

British Insulated Callender's Cables, Ltd.—Increased by £3,000,000, in 500,000 2nd cumulative preference, and 2,500,000 ordinary shares of £1, beyond the registered capital of £22,000,000.

Associated Electrical Industries, Ltd.—Increased by £3,700,000 in £1 shares, beyond the registered capital of £45,000,000.

New Companies

Ward & Goldstone (Export), Ltd.—Registered 28th April. Capital £100. Manufacturers, installers, fitters, maintainers and repairers of, agents for and dealers in electrical appliances and goods, radio and television installations, etc. Directors: E. A. Muller and S. Goldstone. Regd. office: 37, Brown Street, Manchester, 2.

Zeta Domestics, Ltd.—Registered 29th April. Capital £100. Manufacturers of and dealers in vacuum cleaners, radio and television sets, washing machines, cookers, etc. Directors: T. A. Hamilton and M. Miller. Regd. office: 11, Albert Square, Manchester, 2.

Liquidation

Helikon, Ltd., merchants and manufacturers of radio valves, electric lamps and radio and electrical equipment, 234, Bishopsgate, London, E.C.4.—Winding up voluntarily. Liquidator, Mr. P. A. L. Freeman, 8, The Spinney, Stanmore, Middx., appointed 24th April.

Bankruptcies

K. Hanson, trading as Hanson's Electronics at 2, Hall Street, Burnley, and 1, Parker Lane, Burnley.—Trustee, Mr. L. H. Shipton, 31, Lloyd Street, Manchester, 2, released 13th March.

W. R. V. Salt, 232, Archway Road, Highgate, London, N.6, radio, television and electrical engineer.—Last day for receiving proofs for dividend 19th May. Trustee, Mr. A. A. Walter, Bankruptcy Buildings, Carey Street, London, W.C.2, Official Receiver.

N. D. Keene, trading as N. & D. Keene, at 78, Llewellyn Street, Pontygwaith, Glam., radio, television and electrical contractor.—Last day for receiving proofs for dividend today (Friday). Trustee, Mr. W. H. Meredith, County Court Buildings (First Floor), Westgate Street, Cardiff, Official Receiver.

A. Armstrong, 62, Lawson Street, Maryport, Cumberland, electrical goods factor.—Public examination 23rd June at the Magistrates' Court, Nook Street, Workington.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

TUESDAY, 19th MAY

Broadstairs.—Clarendon Hotel, 8 p.m. A.S.E.E. East Kent Branch. "Planned Maintenance," by R. A. Rogers.

Newcastle-on-Tyne.—Crown Hotel, 7 p.m. A.S.E.E. Tyneside Branch. Annual general meeting.

WEDNESDAY, 20th MAY

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Supply Section. "The World Bank—What it is and What it does," by P. J. Squire.

Luton.—Luton Chamber of Commerce, George Street West, 7.30 p.m. A.S.E.E. Luton Branch. Annual general meeting.

Newcastle-on-Tyne.—King's College, Stephenson Buildings, 7 p.m. Society of Instrument Technology, Newcastle Section. Annual general meeting.

Sheffield.—Grand Hotel, 6.30 p.m. I.E.E. Sheffield Sub-Centre. Annual general meeting, followed by "Earthing of Low and Medium Voltage Distribution Systems and Equipment," by F. Mather.

THURSDAY, 21st MAY

Aldershot.—Red Cross Hall, High Street, 8.45 p.m. A.S.E.E. Aldershot and Districts Branch. Discussion on I.E.E. Regulations.

Bradford.—A.S.E.E. Bradford Branch. Visit to British Belting & Asbestos, Ltd., Cleckheaton.

London.—Dorchester Hotel, W., 7 for 7.30 p.m. Institution of Civil Engineers. Annual dinner.

THURSDAY, 21st MAY to WEDNESDAY, 27th MAY

London.—Earls Court. I.E.E. Electronics and Communications Section. International Convention on transistors and associated semiconductor devices.

SUNDAY, 24th MAY to WEDNESDAY, 27th MAY

North Berwick.—Marine Hotel. Electrical Contractors' Association of Scotland. Annual conference.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 29th May:—

Micro Ribbon. No. B778,991. Class 9. Electrical connectors.—Amphenol Electronics Corporation, Chicago, Ill., U.S.A. Address for service, c/o Reddie & Grose, 6, Bream's Buildings, London, E.C.4.

Stantec. No. 781,424. Class 9. Electrical and electronic apparatus and instruments for use in processing information, telecommunication apparatus and instruments, and parts; and insulated electric cables.—Standard Telephones & Cables, Ltd., Connaught House, 63, Aldwych, London, W.C.2.

Ericovox. No. 785,689. Class 9. Telephone instruments and parts.—Telefonaktiebolaget L. M. Ericsson, Stockholm, Sweden. Address for service, c/o Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.2.

Icemaster. No. B783,000. Class 11. Domestic refrigerators.—Bylock Electric, Ltd., 109, South Street, Enfield, Middx.

Combinette. No. 785,733. Class 11. Electric torches for use in connection with photographic flash lamps.—J. J. Silber, 40-46, Lamb's Conduit Street, London, W.C.1.

NEW ELECTRICAL EQUIPMENT

Switch, Connector and Fader

Among the ranges of new equipment recently introduced by ELECTRONIC COMPONENTS, Weedon Road Industrial Estate, Northampton, are front-of-panel rotary stud switches which can be supplied with a free or detent action, and coaxial cable connectors in which the electrical connection is made with the braid sleeve. A knife edge collar is inserted between the inner insulator and the braid, which is then clamped to the collar by a bush gripping the outer covering of the coaxial cable.

Also introduced is a twin-channel quadrant fader in which the two networks can be operated individually or ganged. Two auxiliary changeover contacts at the top and bottom of each network have been provided. A colour changing illuminated scale is fitted, with auxiliary contacts which can be set to determine at what position on the scale the colour change occurs.

Built-in Food Mixer

The latest kitchen appliance to be announced by the KENWOOD MANUFACTURING CO., LTD., Old Woking, Surrey, is a built-in work-top food mixer. It is claimed to give a precisely similar performance to the company's "Chef" food mixer and will take the following attachments:—Liquidiser, mincer, can opener, coffee mill, colander and sieve, slicer and shredder, juice extractor, bean slicer and pea huller and potato peeler. The casing containing the motor and control unit is let into the work top so that when not in use the surface of the work top is flush. Removal of an inset panel reveals two power outlets, high and low speeds, together with a control knob through which a control device is arranged to maintain a high torque at low mixing speeds.

In appearance the new mixer resembles a smaller and more streamlined version of the "Chef" except that it has a coloured "mane" running across the top of the machine. The finish is in white or cream and the motor housing and mounting plate are of aluminium. Measurements of the base panel are 15½in by 10in. The mixer will be available later this year.

Kenwood built-in food mixer

Clothes Dryer

A new dryer has been added to the range of appliances manufactured by the MODERN EQUIPMENT CO., LTD., Court Ash, Yeovil, Somerset. Known as the "Modeq 1500," it will take the place of the "Minor" model which will be discontinued. It has a 1½ kW element and is fitted with a thermostat, and the wooden rack supplied with this and all other models now has an epoxy resin coating. The price is £11 8s 7d.

The models on the market at present are reduced in price as follows:—"Major de-Luxe" (previously £19 19s) now £18 12s 9d. "Major" 2 kW, coated wood rack (previously £14 18s 8d), now £12 19s 5d.

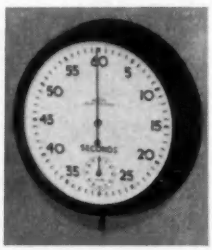
Infra-Red Heater

A new size of industrial infra-red radiant heater has been added to the "Verglo" range manufactured by STEPHEN GLOVER & CO., Intown, Walsall. It measures 48in long overall and is fitted with a 1,500 W element. It has a hammered grey and silver finish and a silver anodised guard and is supplied with ceiling plates and chains. The price is £7.

Seconds Timer

To the range of industrial and scientific timers manufactured by ENGLISH CLOCK SYSTEMS, LTD., 179, Great Portland Street, London, W.1, has been added model ECSO/60SM, which has a 12in dial and a sweep second hand. Incorporated on this main dial is a minute hand and scale marked to record up to 60 minutes. The second hand movement is continuous and may only be stopped by switching off the 200/250 V 50 c/s mains supply, and the minute hand movement is also continuous but may be adjusted or "zero-ed" by turning the setting stem which protrudes from the bottom of the case. The timer, which is priced at £14, has a moulded walnut finish case and is designed for wall fixing.

E.C.S. seconds timer



Valve Voltmeter

The type 614C valve voltmeter recently announced by DAWE INSTRUMENTS, LTD., 99, Uxbridge Road, London, W.5, is a compact, portable instrument for measuring voltages from 80 μV to 300 V at frequencies between 5 c/s and 100 kc/s. It is possible to measure alternating voltages with superimposed direct current, although a combined peak level of 1,000 V should not be exceeded.

The basic circuit comprises a high-gain amplifier which feeds a full-wave rectifying indicating meter through an attenuator with two stages, switched by a 13-position range switch to obtain full-scale deflections of 300 μV, 1, 3, 10, 30, 100 and 300 mV and 1, 3, 10, 30, 100 and 300 V. High calibration accuracy and stability are obtained by negative feedback over the two amplifier stages and by the incorporation of a stabilised h.t. power supply.

Dawe valve voltmeter

The meter is calibrated in r.m.s. values for a sinusoidal input, the indications representing the full-wave average value, and the logarithmic voltage scale gives equal reading accuracy, within ±2 per cent of indication with a sinusoidal input, for all voltages. The frequency error is less than ±3 per cent from 5 c/s to 100 kc/s. An output jack is provided for monitoring the signal or to enable the instrument to be used as an amplifier with a gain of up to 88 dB.

The meter draws some 40 W from 110 V or 200-250 V, 50-60 c/s power supplies. The overall dimensions are 6¼in by 10in by 9½in high and the weight is 10 lb.

Unbreakable Lampshade

Translucent lampshades which are rigid, low in weight and virtually unbreakable have recently been introduced by H. W. FIELD & SON, LTD., Harold Wood, Essex. Named the "Fildenex" No. 5, they are available

in five colours—opal white, pink, yellow, green and blue. They can be used for single or multi-pendant fittings, or for wall bracket fittings, and are suitable for lamps of up to 100 W. The lampshades are blow-moulded in "Rigidex" high density

Field "Fildenex" No. 5 lampshade

polyethylene, supplied by British Resin Products, Ltd., and ventilation holes are provided in the top. The overall length is 8in and the price, including purchase tax, is 4s 9d.

P.T.F.E. Dielectric Condensers

Polytetrafluoroethylene (P.T.F.E.) is a material possessing good electrical properties over a wide range of temperature, and condensers with P.T.F.E. dielectric, exhibiting a substantially constant capacity, high insulation resistance and low power factor under working conditions extending from −55 to +200 deg C, have recently been introduced by the Radio Division of the TELEGRAPH CONDENSER CO., LTD., North Acton, London, W.3.

The P.T.F.E. and foil elements are contained in heavily tinned brass tubes, with ceramic end discs soldered in place with high melting point solder to form a hermetic seal capable of withstanding Category H.1 humidity tests. The wire terminations passing through the end seals are of 21 s.w.g. tinned copper and extend for 1½in. The condensers, which range in capacity from 0·015 to 0·1 μF, have a working voltage of 500 V d.c. and a test voltage of 1,500 d.c. at room temperature. No voltage derating is required up to 150 deg C but at the upper temperature limit the applied working voltage should be reduced by one-third.

Polarising Supply Unit

Two units, the models PNI 1034 and PNI 1042, are available from PLESSEY NUCLEONICS, LTD., Weedon Road, Northampton, for polarising ionisation chambers used in the flux measuring channels of nuclear reactor instrumentation systems. The h.t. output, from 400 to 600 V, is derived from a transistor convertor circuit, and an alarm relay is provided which indicates output failure or disconnection. A number of polarising supplies are normally operated from a common low voltage secondary battery but individual miniature, sealed, secondary batteries could alternatively be mounted internally.

Plessey polarising supply unit

High Temperature Capacitors

A range of silvered mica capacitors for use over the temperature range of −70 to +250 deg C and protected by a dip coating of silicone rubber has been announced by JOHNSON, MATTHEY & CO., LTD., 73-83, Hatton Garden, London, E.C.1. Fired construction is employed, the individual silvered mica plates being bonded into a solid block. Two standard sizes are manufactured and any capacitance value in the range 5 to 50,000 μμF can be supplied to a minimum tolerance of ±½ per cent or 1 μμF, whichever is the greater. Each size is available rated at 200 V or 350 V peak for temperatures up to 100 deg C, reduced to 100 V or 200 V peak at 250 deg C.

Reverse Action Thermostats

Two new reverse action "Kieft" thermostats, specifically designed for fan control, have been introduced by the Thermostat Division of R. B. PULLIN & CO., LTD., Phœnix Works, Great West Road, Brentford, Middlesex. The two models are the A55/RA (80-250 V a.c.) and the A55/RANL (0-250 V a.c.) which is identical to the A55/RA except that it does not include a neon indicator. The temperature range is 90 to 30 deg F. Both models will switch an inductive load of up to 5 A, where the power factor is not less than 0·7, but will, however, carry a starting current of up to 15 A. The outside casing is of plastic and the finish ivory.

"Kieft" type A55/RANL reverse action thermostat (Pullin & Co.)

Bench Light

The "Flexaflor" bench light introduced by F. W. THORPE, LTD., Thorlux Works, Welby Road, Hall Green, Birmingham, 28, has a zinc coated trough containing a polished aluminium reflector fitted with miniature bi-pin holders for two 8 W fluorescent lamps. The support arm is constructed of tubular steel with knuckle joints, swivelling at both base and reflector. The base houses the control gear, though this can be arranged for remote mounting if desired, and carries a switch suitable for a variety of mountings.

The fitting has a clear or opal cover which may be removed for reflector cleaning or lamp replacement. The

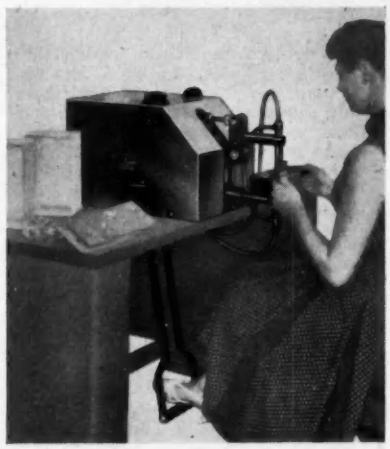
Thorpe bench light

price, which includes 200/250 V switch start control gear but not lamps, is £7, or £5 15s 4d without control gear. Control gear for 110 V supplies can be supplied if required and 9in support arms are available.

Spot Welder

A self-contained foot pedal operated bench model spot welder, capable of welding foil down to 0·003in thick and sheet steel up to 2×16 s.w.g., has been announced by TRIANGLE PRODUCTS, LTD., Hyde, Cheshire. Rated at 7·5 kVA, the unit is available in standard form for operation from 200, 220, 240, 380, 415 and 440 V single-phase, 50 c/s supplies. An electronic timer is incorporated covering a range of 5 to 75 cycles, and six heat stages selected by a rotary switch offer a wide choice of welds for various applications. Copper welding arms 1¼in in diameter and 6in long, giving a 6¾in throat reach, are supplied as standard, but 12in arms giving a 12¾in reach are

Triangle spot welder



available, and the width between tips with the standard arms open is 5½in. Water cooling is employed, requiring a 2 gal capacity tank beneath the bench. A flow of cooling water to the electrode tips is obtained mechanically when the foot pedal is depressed.

Corrosive Gas Fans

In addition to the range of moulded p.v.c. fans based on their original "Monogram" series, the Sturtevant Engineering Co., Ltd., has now produced, in conjunction with Acalor (1948), Ltd., a range of fans to handle corrosive fumes and gases based on its original "D" series. These fans have an all-p.v.c. casing with clad impeller, the impeller and base being of standard design. This development offers an alternative to the all-fabricated p.v.c. fan and has the advantage of safe, high operating speeds, and greater efficiencies than can be obtained in many instances with the fabricated p.v.c. impeller. An all-p.v.c. fabricated impeller will, however, be available shortly if desired as an alternative. Full particulars are available from either the STURTEVANT ENGINEERING CO., LTD., Southern House, Cannon Street, London, E.C.4, or ACALOR (1948), LTD., Kelvin Way, Crawley, Sussex.

Miniature Circuit-Breaker

The latest miniature circuit-breaker introduced by the M.C.B. Co. (MANCHESTER), LTD., Lupus Works, Oxford Road, Altrincham, Cheshire, is based on the original "Lupus Senior" but

Sectioned view of the "Lupus Midget" circuit-breaker

is of reduced size. Units are available rated for 5, 10, 15, 30 or 50 A capacity, at up to 440 V a.c.—250 V single-pole and neutral and 440 V triple-pole and neutral—at all power frequencies from 25 to 400 c/s or up to 125 V d.c. for substantially non-inductive loads. The "Lupus Midget" incorporates a combined thermal and magnetic protective unit in which a combination of bimetallic and electromagnetic trips give correct protection under all conditions of operation, with a relatively long time delay for small overloads, shortening to instantaneous tripping on short circuit. The contacts have integral arcing tips and a wiping/rolling action, the main faces being of silver-plated copper with anti-welding "Elkonite" tips. Three adaptors enable the standard breaker with front or back cable entry to be converted for standard busbar connection, plug-in fitting or back-stud mounting.

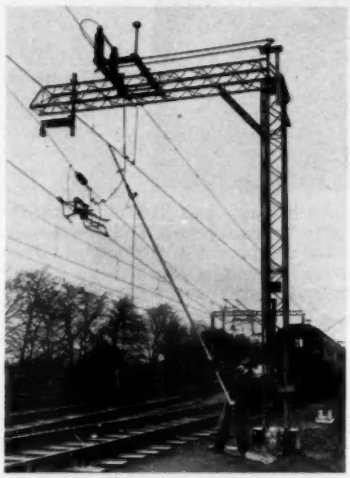
Aluminium-Faced Asbestos Cloths

A range of woven asbestos cloths having a coating of reflective aluminium for use in industries concerned with thermal insulation problems has been added to the range of cloths produced by the TURNER BROTHERS ASBESTOS CO., LTD., P.O. Box No. 40, Rochdale, Lancs. These fabrics are also of use for fire fighting and protective clothing.

High Voltage Indicator for Railways

A high voltage indicator to measure the voltages on 25 kVA a.c. overhead electrified railway lines has been developed by Ferranti, Ltd., at the request of British Railways. The indicator is of the electrostatic type with two ranges, 0 to 15 and 0 to 30 kV, and the scale is marked with black figures on a white background to facilitate reading from below, while the angle of the meter may be varied as desired. The testing rod comprises three 4ft long sections. The top section, carrying a steel hook enabling the indicator testing head to be hooked over the required conductor, is made of thick bakelised paper, and the remaining sections are of glass fibre. The complete equipment is portable, the rod, voltmeter and earthing lead being dismantled and packed in a lightweight carrying case.

Ferranti high voltage indicator



Hardboard Manufacture

A new hardboard manufacturing plant was recently commissioned by the Patent Impermeable Millboard Co., Ltd., at Sunbury-on-Thames. Scots fir thinnings are reduced first to chips and then to fibres in the three de-fibreing machines, two of which are powered by 250 h.p. slip ring motors and one by a 300 h.p. motor.

The wood chips are passed through a steam preheater and then forced between two high-speed rotating discs. The resulting pulp is formed into the required thickness and width under automatic control on the wet lap forming machine. The solid pulp is sawn into over-sized widths and passed to the hydraulically operated hot platen press.

After pressing, the hardboard is automatically discharged and loaded on to a rail-directed trolley. The loaded trolley passes into the heat treatment oven and then into the humidifier. All motors used in the new plant are of Crompton Parkinson manufacture and a new h.v. substation houses Crompton Parkinson 6·6 kV isolators, a 500 kVA 6·6/415 V transformer and a Klad 415 V 25 MVA switchboard. All conveyors are motorised and the motor control gear, which is of Swedish manufacture, is sequence interlocked.

New hardboard factory showing wet lap forming machine on the left and ovens and humidifier on the right

Electrical Manufacturing Statistics

First Comprehensive Figures of Deliveries and Order Books

IMPORTANT new statistics of home and export deliveries and order books in the mechanical and electrical engineering industries have been collected by the Board of Trade. The figures were published for the first time in last week's *Board of Trade Journal* and will be continued at regular intervals. They supplement and will probably eventually replace the information on the production and deliveries of certain items of electrical equipment and appliances at present published in the *Monthly Digest of Statistics*.

As will be seen from Table 1, the new statistics include for the first time the production of transformers, switchgear and control gear, and give an overall figure for the production of domestic electrical appliances. The activities of firms engaged on sub-contract work are also covered. The responsibility for the collection and publication of more detailed statistics on the production of individual appliances will now fall on the electrical industry. The British Electrical and Allied Manufacturers' Association is already tackling the problem and is endeavouring to persuade manufacturers that it is in their own interests to co-operate in providing the necessary information. Secrecy of individual firm's figures will be preserved by putting the collation of statistics in the hands of a firm of chartered accountants. It is yet to be decided whether the final figures will be published or circulated privately to the manufacturers concerned.

Interpretation of Figures

In an article accompanying the figures in the *Board of Trade Journal* it is explained that, under the new scheme introduced last year, monthly returns are obtained from a sample of firms, including all the largest, and quarterly returns from the rest. From these returns monthly estimates are made of changes in the activity and order position of the group of industries as a whole, which are completed when the quarterly returns have been received. The first monthly estimate is made, and included in the preliminary estimates of the Index of Industrial Production, about three weeks after the end of each month.

Monthly forms were sent to about 1,000 firms and quarterly forms to about 4,000. The great majority of firms are stated to have been "most co-operative" and as a result returns have been received for the whole, or a substantial part of, 1958, from firms estimated to be responsible for nearly 99 per cent of total deliveries by all firms who were asked for returns; the smallest firms, who were not asked, are estimated to produce about 2 per cent of the total output of the industries covered.

The figures in Table 1 are not aggregated into totals because, for example, some electric motors included under the heading of rotating electrical machines will also be included in the value of machine tools or of domestic electrical appliances delivered. Some of the figures for individual categories may also include double counting of this type. The figures under each heading include parts of the specified machinery if those parts were delivered mainly for replacement, but firms making parts for incorporation in other firms' products were asked to show them under the heading for sub-contract sales and sundry components. The figures include estimates for missing returns, but not for the output of the firms not asked for returns nor for firms outside the industry who make goods of the kind covered as a subsidiary activity.

The figures of production, exports and orders on hand shown in Table 2 cover the engineering and electrical industries as defined in Order VI of the Standard Industrial Classification and include the telegraph and telephone apparatus and radio and electronic apparatus omitted from Table 1.

The article contains warnings on the interpretation of the statistics and in particular the indices of orders on hand. An upward movement over a period, it explains, implies that more new orders were being received than goods delivered and orders cancelled, and vice versa. A downward movement could therefore as much be due to a high level of deliveries as to a low level of new orders received, and a recovery in new orders will not lead to a rise in orders on hand until new orders exceed deliveries; it may well show first in an increased rate of deliveries, especially if manufacturers have accumulated stocks. Moreover, order books can also be overfull, and delivery periods correspondingly inconveniently long. Comparison of deliveries and order books figures should provide a measure of the rate at which new orders

TABLE 1.—DELIVERIES OF CERTAIN ELECTRICAL ENGINEERING PRODUCTS IN 1958
(£ million)

	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Total
ELECTRICAL MACHINERY					
Rotating electrical machines	28·5	30·1	26·0	37·4	122·0
Transformers for lighting, heating and power	11·0	10·7	9·3	11·0	42·0
Switchgear and control gear	27·2	27·4	25·1	28·2	107·9
Other electrical machinery	4·0	4·0	3·5	4·2	15·7
INSULATED WIRES AND CABLES	29·4	27·8	25·3	31·6	114·1
OTHER ELECTRICAL GOODS (except radio, telecommunication and other electronic apparatus)					
Domestic electrical appliances	19·8	23·1	23·2	37·4	103·5
Electrical equipment for motor vehicles, cycles and aircraft	12·3	12·5	10·5	11·5	46·8
Primary batteries	2·9	2·6	3·1	3·6	12·2
Secondary batteries (accumulators)	5·6	5·1	5·2	6·4	22·3
Electric lamps	6·0	5·4	5·2	7·1	23·7
Other electrical goods	15·0	14·9	14·9	17·6	62·4

TABLE 2.—VOLUME OF PRODUCTION, EXPORTS AND ORDERS

	Electrical Engineering production 1954 = 100	Exports Mechanical & Electrical 1954 = 100	Orders on hand Mechanical & Electrical		
			Total	Export	Home
			Jan. 1958 = 100		
1954	100	100	96	91	99
1955	111	109	105	94	109
1956	111	116	104	102	105
1957	118	117	101	101	101
1958	124	112	87	85	88
1959: January	—	—	87	84	87
February	—	—	85	83	85

are being received (less cancellations), but it has not yet been practicable to make this comparison for this group of industries. The index of production is not appropriate for this purpose, for much the same reasons as it cannot be directly compared with the index of exports: it is not a measure of final output.

Trends in Production, Exports and Orders

In electrical engineering, which has been expanding about twice as fast as mechanical engineering since 1948, there was an increase in production of 5 per cent in 1958. A substantial part of this increase was due to the expansion in production of electrical appliances which followed the reduction in purchase tax on many goods in the 1958 Budget, and the progressive relaxation and eventual abolition of restrictions on credit trading in the autumn. Provisional estimates for January and February, 1959, indicate that production in the engineering and electrical goods industries combined, continued above the level of the corresponding period a year earlier, by 4 per cent, but the increase was less marked in February.

The total volume of exports of products of these industries increased by 9 per cent in 1955, by 7 per cent in 1956, and by between 1 and 2 per cent in 1957; in 1958 there was a fall of 4 per cent but some evidence of recovery in the figures for the final quarter of the year.

The indices of orders on hand indicate that total order books ceased to grow in 1956, and have fallen consistently since September, 1957. If the figures for earlier years are regarded as comparable (which, it is pointed out, is a bold assumption), it appears that the volume of orders held at the end of February, 1959, was some 10 per cent less than at the end of 1954. Smaller order books usually, however, imply quicker delivery and to that extent, greater competitive power in the world markets. Orders on hand for the home market began to fall in 1956, but export orders did not reach their peak until early in 1957; since then, home and export orders have fallen in about the same proportion, and the latest figures, for February, provide no evidence of a check to this movement.

New Books

Foundations of Electrical Engineering. Vol. II. By H. Cotton and E. W. Golding. Pp. 252; figs. Sir Isaac Pitman & Sons, Ltd., Pitman House, Parker Street, Kingsway, London, W.C.2. Price 30s.

This volume by two well-known authors is principally concerned with those sections of alternating current theory that are usually included in the S3 Course for the Ordinary National Certificate in Electrical Engineering. The treatment is based upon the M.K.S. system of units, and an introductory chapter is devoted to a summary of the basic mechanical and electrical units. This is followed by chapters dealing with the generation of e.m.f. and with sinusoidal and non-sinusoidal waves. The problem of complex waveforms is probably a little beyond the normal S3 syllabus, but there is much to be said for making a reference to this subject.

Subsequent chapters deal very clearly but quite conventionally with series and parallel circuits possessing combinations of resistance, inductance and capacitance. The authors have wisely devoted a separate chapter to symbolic notation. The treatment of single-phase transformers and of polyphase circuits and induction motors is thorough and lucid. The last two chapters, on electronics and measuring instruments, are disappointing and give the impression of having been hurriedly compiled; for instance, some of the labelling on Fig. 16.14 is misleading and Fig. 16.15 is not complete, and it is doubtful if a student will gain any useful information from the very brief descriptions of the various electrical instruments and meters.

The book has about 90 numerical problems with answers. The diagrams are clear and the text is particularly free from typographical errors. This volume can be recommended for National Certificate students, but it is unfortunate that the price is so high.—E.H.

Practical Robot Circuits. By A. H. Bruinsma. Pp. 134; figs. 53. Price 17s 6d. **Multivibrator Circuits:** Introduction to Robot Technique. By A. H. Bruinsma. Pp. 74; figs. 41. Price 9s 6d. Philips Technical Library distributed in Great Britain and Eire by Cleaver-Hume Press, Ltd., 31, Wright's Lane, Kensington, London, W.8.

The first of these two new books, which have recently been added to the Philips Technical Library, Eindhoven, Holland, gives a detailed description of two robot systems that have been developed as demonstration models, a "dog" and a noughts and crosses machine. The basic principles of robot circuits and their response to external stimuli are discussed, followed by an account of the electronic sensing organs in the "dog," including stereoscopic vision using photo-electric cells and stereophonic hearing, and the assimilation of stimuli by an electronic "brain." A chapter is devoted to some of the mechanical design and power supply problems encountered in constructing the model. The reactions of this type of robot to stimuli are predetermined and correspond only to what are known as reflex actions in living creatures. Other forms of electronic "brains," however, respond to changing circumstances by selecting from a number of possibilities and, to demonstrate the possibilities of electronics thus employed, a model specialising in the game of noughts and crosses was made, its design and construction being described in the final chapter.

Most of the problems arising in electronic robot systems can be solved, or solved better, by using multivibrator circuits and auxiliary gate circuits. A detailed description of these and the newer square-wave voltages and the pulse voltages derived therefrom is given in the book "Multivibrator Circuits." The first chapter deals with such subjects as the operating principles of free running multivibrator circuits, pulse width, shape and differentiation, synchronisation, and monostable and bistable circuits, while the second chapter covers gating valves.—T.R.W.

BOOKS RECEIVED

Directory of Opportunities for School Leavers 1959. Pp. 188. Cornmarket Press, Ltd., 1, Lower James Street, London, W.1. Price 8s 6d.

Practical Dictionary of Electricity and Electronics. By R. L. Oldfield. Pp. 216; figs. Technical Press, Ltd., 1, Justice Walk, Chelsea, London, S.W.3. Price 52s.

Electrical Engineering: Theory and Practice. 2nd edition. By William H. Erikson and Nelson H. Bryant. Pp. 614; figs. John Wiley & Sons Inc. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 64s.

Automation Today and Tomorrow. By L. Landon Goodman. Pp. 280. Iota Services, Ltd. Distributed by Newman Neame, Ltd., 50, Fitzroy Street, London, W.1. Price 40s.

Principles of Alternating Currents. 2nd Edition. By W. Sluckin and J. R. Greener. Pp. 338; figs. Cleaver-Hume Press, Ltd., 31, Wright's Lane, Kensington, London, W.8. Price 15s. This revised edition is augmented and includes the use of M.K.S. units.

Electrical Machinery Trades Convention

MECHANICAL VIBRATION AND MOTOR APPLICATION DISCUSSED

THE annual convention of the Association of Electrical Machinery Trades was held at Bournemouth from 2nd to 5th May under the chairmanship of Mr. C. G. Aldridge. The delegates attending with their wives and families enjoyed the customary good weather associated with this convention, although this year a departure had to be made from the traditional last week-end in April. The social programme began on the Saturday evening when an informal dance was held after dinner, and the Convention's business commenced on Monday morning when the Council meeting was held.

In the afternoon a paper on mechanical vibration problems was presented by Mr. J. Nicholaisen (Silentbloc, Ltd.). After explaining the duties of a vibration insulator, Mr. Nicholaisen suggested that the only perfect insulator was empty space and that it was logical to consider the behaviour of any unit as if it was floating in space. In general, the motion of a body could be described by translations along its three principal axes through the centre of gravity, and three rotations around these axes. The body thus had six degrees of freedom and three planes of symmetry. In practice, mounting systems symmetrical with all three planes were seldom encountered, but any one system could be represented by a number of "single-mass" systems, one for each degree of freedom of the original system.

Mr. Nicholaisen dealt with the performance of single-mass systems and damping, explaining the hysteresis effect caused by the time lag of the deflection behind the applied load. Sub-frames which were to be flexibly mounted should have sufficient stiffness for the complete assembly to be considered as one rigid unit, and the author suggested that a reinforced concrete sub-frame both increased the effective mass of the unit to be insulated and provided the necessary stiffness. Mr. Nicholaisen then considered the mounting of instruments on vibrating machinery, where it was normally only necessary to protect against the higher frequencies encountered. In his conclusions he thought it important to use calculation methods enabling results to be achieved quickly, and the effect of the probable errors in the basic data and assumptions to be assessed. A discussion followed in which mention was made of the use of models to obtain scale results, and a vote of thanks was proposed by Mr. R. A. Joseph.

On the Monday evening a reception and dinner at the Marsham Court Hotel was followed by a visit to the Pavilion Theatre.

The second paper, "Electric Motor Applications," was presented by Mr. F. T. Bartho (Crompton Parkinson, Ltd.) on the Tuesday morning. Speaking of the change from a single engine drive for a number of machines to the individual motor drives which became prominent during the war, he felt that the most satisfactory method employed a motor driving small groups of machines, although with modern light-framed buildings individual drives were often necessary. He considered the mechanical characteristics of motors under three headings: starting torque; accelerating torque; and running torque. Several factors were discussed, including starting time which was important in starter resistance rating, the use of the r.m.s. value of the duty cycle to reduce the motor size for a particular application, and the selection of low temperature rise squirrel cage motors if high inertia loads were to be started.

Mr. Bartho thought that too few people appreciated the difference between constant torque and constant horse-power. Although a constant horse-power motor would drive a constant torque application, the excess torque at the lower speed might be dangerous should the driven machine seize. Squirrel-cage and slip-ring motors were discussed and also the temperature rise and overload ratings included in the 1957 edition of B.S. 2613. Speaking of motor ventilation, the author referred to the importance of the winding hot spot temperature and to the use of large quantities of air at high velocity with modern cooling methods, and he concluded by saying that trouble could often be prevented by an analysis of the mechanics

Some of the members of the Association and their guests at Bournemouth

of the drive, as it was invariably the drive which transmitted the trouble to the motor.

In the discussion which followed Mr. Joseph and Mr. A. H. Spindler spoke of the definition of machine tool rating, suggesting that there was a need for an official ruling on this definition. Mr. T. A. Atkinson thought that many motor breakdowns were due to voltage surges on switching off, subsequently believed to be failures occurring at the next start, and suggested that it would be preferable to switch motors off while still under load. Mr. F. H. Washington asked if buffer resistances could be used to limit surges, but Mr. Bartho said that they could not carry the high currents which occurred if a "short" developed on the machine. Extra insulation on winding end turns was discussed, followed by the use of motors on incorrect voltage supplies, and rotor bar breakages. The Association's chairman, Mr. Aldridge, asked if any of the latest adhesives had been used for securing rotor bars and Mr. W. Womersley referred to the use of epoxy resins in certain repairs.

A vote of thanks to Mr. Bartho was proposed by Mr. Washington.

Southern Region Electric Locomotives

ELECTRIC locomotives for certain types of train are to be employed by the Southern Region of British Railways in connection with their Kent coast electrification. Experience with the earlier Co-Co type electric locomotives has indicated that more powerful units would be necessary if the close headways possible with multiple unit stock were to be maintained. It was considered that a locomotive of about 2,500 h.p. was required and that it should be of the mixed traffic type, but capable of a high maximum speed.

The first of a new type of electric locomotive, No. E.5000, has now been completed in the British Railways workshops at Doncaster. The initial order, comprising 13 locomotives, will be required to handle freight trains of up to 900 tons over the heavily graded routes of the South Eastern Division. They will also be called upon to operate, to express schedules, thirty or more Continental train ferry vehicles and passenger trains. These duties demand a locomotive having good adhesion characteristics with a large number of running notches and a fairly wide range of traction motor field weakening.

The existing Co-Co locomotives, which employ two separate booster motor-generator equipments, have given good service. Modern techniques, however, have enabled increased power to be obtained from a single equipment. It was therefore decided to have a single equipment with the traction motors connected in parallel in place of the series connections of the earlier locomotives.

As these locomotives will be employed extensively on freight trains, it has been necessary to electrify access roads to a number of large yards and, to obviate the risk to staff from contact with the conductor rail, overhead conductors are being installed in a number of places. The locomotives are accordingly equipped with a double-pan pantograph which will be of ample capacity to deal with the comparatively low currents and speeds met with in yard work.

A single booster motor-generator set of large capacity is provided, the generator of which is connected in series between two parallel pairs of traction motors wound for full line voltage. The output of this machine is 945 kW at 1,750 r.p.m. and the motor of the set has a continuous rating of 1,360 h.p. at 675 V. The armatures of both machines are identical and interchangeable although the frames and field systems are necessarily different.

Starting of the booster set is under the control of an electrically-driven camshaft and a series resistance is cut out in six steps under time control. This camshaft is also used to re-insert resistance during gap operation, in readiness for accelerating the set back to normal speed on regaining the conductor rail.

Control of traction motor voltage is achieved by bucking or boosting the line supply by suitable variation of the booster generator excitation. An electrically-driven camshaft, controlled directly from the driver's master controller, provides for 33 running notches, of which the last four control traction motor field weakening.

First of the new 2,500 h.p. Bo-Bo electric locomotives for use on the Southern Region Kent coast electrification

European Railway Electrification

FRENCH Railways have announced the introduction of electric traction on two more sections of line in North-Eastern France, namely Conflans to Pagny-sur-Moselle (21 miles) and Metz to Lerouville, Bar-le-Duc and Revigny (72 miles). These sections, for which the 25 kV, 50 c/s system has been used, complete links between the already electrified Lille-Bâle line and the Paris-Strasbourg line now in course of electrification. The second section also covers part of the Paris-Strasbourg line between Lerouville, Bar-le-Duc and Revigny. The total length of electrified lines on the French Railways is now 4,251 miles; of this 1,056 miles is operated at 25 kV 50 c/s and almost all of the remainder at 1,500 V d.c.

Last week the West German Federal Minister of Transport, Dr. Seebohm, officially inagurated the newly electrified railway line from Düsseldorf to Remagen. He said it was now possible to travel by electric train the whole way from the Ruhr to Southern Italy.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1954

6607. Jackson, S. W., Robinson, S., and Howden, J. M. (trading as British Northern Electrical Appliances).—Counting mechanism. 11th May, 1955. (813258.)

16451. Dubilier Condenser Co. (1925), Ltd.—Electrical capacitors. 1st September, 1955. (813431.)

29259. Telephone Manufacturing Co., Ltd.—Signal switched telecommunication circuits. 10th October, 1955. (813432.)

32600. Telling, S. J., and Rayner, L. F. (trading as Page Engineering Co.).—Electric terminal blocks. 10th November, 1955. (813433.)

34453. Automatic Telephone & Electric Co., Ltd.—Electrical signalling systems. 17th August, 1955. (813338.)

37316. Cole, Ltd., E. K., and Levi, J. E. —Rotary electric switches. 28th December, 1955. (813373.)

1955

2047. National Research Development Corporation. — Two-state semiconductor devices. 22nd February, 1956. (813441.)

24470. Communications Patents, Ltd.—Radio training apparatus. 25th August, 1955. (813380.)

28580. Ericsson Telephones, Ltd.—Modulating circuit arrangements particularly for voice frequency telegraph systems. 7th October, 1955. (813264.)

30901. Rank Cintel, Ltd.—Methods of manufacturing target electrodes for electron-discharge devices. 26th October, 1956. (813387.)

35272. General Electric Co.—Electrolytic capacitors. 8th December, 1955. (813391.)

35479. Chicago Telephone Supply Corporation.—Variable resistor unit. 9th December, 1955. (813454.)

36365. Metallurgical Chemists, Ltd.—Electrostatic crop dressing apparatus. 11th December, 1956. (813388.)

36672. Pickering Associates, Inc.—Electrostatic transducers. 21st December, 1955. (813455.)

36958. Sodeco, Soc. des Compteurs de Genève.—Impulse counter. 23rd December, 1955. (813268.)

1956

6303. Imperial Chemical Industries, Ltd. —Protective systems for transportable electrical equipment. 27th February, 1957. (Cognate application 24564, 10th August, 1956.) (813748.)

9764. M-O Valve Co., Ltd.—Magnetrons. 28th March, 1957. (813458.)

12066. Falk, Stadelmann & Co., Ltd.—Tumbler operated electric switch. 23rd April, 1957. (813459.)

14358. Morley Products (Padiham), Ltd. —Cut-out arrangement for electrical heating apparatus. 9th May, 1957. (813461.)

16490. Bristol Co.—Mechanical electrical transducers. 28th May, 1956. (813274.)

17797. Mullard Radio Valve Co., Ltd.—Electric circuit arrangements for supplying a load with alternating current. 8th June, 1956. (813285.)

22115. General Electric Co.—Clothes drying apparatus. 17th July, 1956. (813190.)

22258. British Thomson-Houston Co., Ltd.—Arrangements including electrically insulating bushing assemblies. 8th July, 1957. (813464.)

23565. Electric Storage Battery Co.—Negative plates for storage batteries. 31st July, 1956. (813408.)

23846. Clevite Corporation.—Acoustic torpedo having pressure compensated transducer. 2nd August, 1956. (813278.)

28825. Erg Industrial Corporation, Ltd., and Alexander, J. A.—Electrical components. 19th September, 1957. (813465.)

28967. Plessey Co., Ltd.—Circular track variable resistors and potentiometers. 18th December, 1957. (813467.)

29380. Sperry Rand Corporation.—Detectors for radio navigation receivers. 26th September, 1956. (813200.)

31795. General Electric Co., Ltd.—Electric discharge devices. 30th September, 1957. (813761.)

32368. Cooke & Co., Ltd., H. S.—Electric lampholder liners and their manufacture. 14th October, 1957. (813203.)

32439. British Thomson-Houston Co., Ltd.—Electrical pyrometers. 24th October, 1957. (813411.)

33129. Enfield Cables, Ltd.—Sheath anchoring devices for electric cable ends. 29th July, 1957. (813354.)

33986. Elastic Stop Nut Corporation of America.—Electrical connection assembly. 7th November, 1956. (813205.)

35227. Elcalor Aktiengesellschaft Fabrik für Electrothermische Apparate.—Electric oven temperature regulators. 19th November, 1956. (813356.)

37314. Brown Boveri & Cie. A.G.—Turbines or compressors. 6th December, 1956. (813144.)

39557. Siemens & Halske A.G.—Magnetically operated electric contact devices housed in protective tubes. 28th December, 1956. (813292.)

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2142. Trott, W. A.—Wall or ceiling lighting fittings. 21st January, 1957. (813215.)

2516. Foxboro Co.—Multiple source radioactive device. 23rd January, 1957. (813148.)

2645. Pour l'Industrie de l'Aluminium S.A.—Electrolytic cells for the production of aluminium. 24th January, 1957. (813216.)

11175. Bofors A.B.—Apparatus registering electrical voltages. 5th April, 1957. (813295.)

13871. Standard Telephones & Cables, Ltd.—Metal rectifier stack assemblies. 1st May, 1957. (813299.)

17157. Automatic Telephone & Electric Co., Ltd.—Electrical signalling systems. 17th August, 1955. (Divided out of 813338.) (813339.)

22905. General Motors Corporation.—Electrical strain gauge. 19th July, 1957. (813303.)

23052. White, C. J.—Push-pull electronic valve amplifiers. 4th October, 1957. (813669.)

25957. Amp, Inc.—Electrical connectors and electrical connections and methods of making the connections. 16th August, 1957. (813160.)

27409. Standard Telephones & Cables, Ltd.—Deflecting coil arrangement for cathode-ray tubes. 30th August, 1957. (813238.)

30333. Standard Telephones & Cables, Ltd.—Vacuum deposition equipment. 11th June, 1956. (Divided out of 803251.) (813252.)

30751. United-Carr Fastener Corporation. —Electrical connector assemblies. 18t October, 1957. (813424.)

31818. General Electric Co.—Waste disposal apparatus. 11th October, 1957. (813304.)

33128. Sperry Rand Corporation.—Transistor integrating circuits. 23rd October, 1957. (813307.)

35664. Philips Electrical Industries, Ltd. —Crucibles of refractory semiconductive material. 15th November, 1957. (813166.)

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331. Standard Telephones & Cables, Ltd. —Compact electric circuit assembly. 3rd January, 1958. (813426.)

33424. Amp, Inc.—Electrical connectors and connections. 22nd July, 1955. (Divided out of 812279.) (813427.)

STREET LIGHTING PLANS

Birmingham Public Works Committee considers it desirable to embark on a scheme for the replacement and improvement of all group "A" lighting in the city which is below the present national standards. The total estimated cost is £690,000.

Further electric street lighting schemes estimated to cost about £11,000 are to be considered by **Darlington** Town Council after the present street lighting works are completed.

The borough surveyor of **Ealing** is to prepare a scheme for sodium lighting in Ruislip Road. The estimated cost is £13,700.

Fylde (Lancs.) R.D.C. has approved a scheme, estimated to cost £20,000, for the lighting of Blackpool Road, Westby.

Guildford Works Committee has approved a scheme for class "A" mercury vapour lighting in Farnham Road at an estimated cost of £5,000.

The third phase of the conversion of street lighting from gas to electricity in **Leicester**, which the City Council has been recommended to approve, is estimated to cost £20,000.

During the current year **Middlesbrough** Town Council intends to start work on electric street lighting schemes costing £28,000.

Newcastle-on-Tyne City Council has received permission to borrow £67,216 for the fourth stage of its scheme for converting the street lighting from gas to electricity.

Ossett Corporation is recommended to seek sanction to borrow £5,355 for street lighting in Kingsway, Queen's Drive, Leses Road, and Pildacre Lane.

Street lighting improvements costing £4,000 are proposed by **Rugby** Town Council.

Seaham U.D.C. has included £3,783 in its estimates for improvements to electric street lighting.

Shipley Highways and Buildings Committee, which is to convert the remaining gas street lighting in the town to electricity, proposes to accept the quotation of the Yorkshire Electricity Board amounting to £32,530 for the provision of 1,305 lighting points.

The Electricity and Lighting Committee of **Shrewsbury** Town Council proposes to spend £9,625 on street lighting improvements.

Under the current year's programme for the electrification of public lighting in **Southport** 120 streets are to be dealt with and 1,025 lamps installed. It is planned to complete the conversion by the end of 1961.

Stoke-on-Trent Corporation plans to begin next year a scheme for the elimination of all the gas street lighting in the city. The work will be spread over nine years.

Wallasey Works Committee has approved a scheme for the conversion from gas to electricity of the street lighting in Marlowe Road, Victoria Road/Warren Drive, Fender Lane, Church Street and Marine Promenade, at an estimated cost of £12,320.

Ratepayers at **Wistaston**, near Crewe, have voted in favour of deferring consideration of a £9,000 street lighting scheme until next year.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Australia.—State Electricity Commission, Brisbane. 20th May. 30,000 single-phase electricity meters. (E.S.B. 11007/59. Ten/38931.)*

Electricity Commission of New South Wales, Sydney. 25th May. Forty-one 66 kV outdoor circuit-breakers and 123 single-phase current transformers. (E.S.B. 8843/59. Ten/38941.)*

Belgium.—Ministère de la Défense Nationale, Brussels. 10th June. Forty-eight communication sets. (E.S.B. 10584/59. Ten/38855.)*

Bilston.—Corporation. 29th May. Street lighting equipment. (See this issue.)

Bradford.—Corporation. 30th May. Trunk road lighting equipment. (See this issue.)

Burma.—Burma Purchase Board, Rangoon. 20th May. Battery plates. (E.S.B. 11062/59. Ten/38912.)* Ten battery chargers. (E.S.B. 11063/59. Ten/38913.)*

Canada.—Committee of Public Works, Winnipeg. 20th May. Metalclad switchgear. (E.S.B. 10868/59. Ten/38909.)*

Coulsdon and Purley.—U.D.C. 26th May. Group "A" sodium street lighting equipment. (See this issue.)

Durham.—County Council. Electrical installation in Consett New Technical College. (See this issue.)

Edinburgh.—North of Scotland Hydro-Electric Board. Electrical installation and other subsidiary services at Cassley power station. (See this issue.)

Esher.—U.D.C. 22nd June. Street lighting equipment. (See this issue.)

Formosa.—Central Trust of China, Taipei. 29th May. Twelve 25 kVA transformers, three 75 kVA transformers, lightning arrestors, fuse cutouts and fuse links. (E.S.B. 11016/59/I.C.A. Ten/38951.)*

Harlow.—U.D.C. 23rd May. Street lighting equipment. A. W. R. Webb, surveyor, Netteswell Hall.

Heston and Isleworth.—Corporation. 5th June. Group "A" street lighting equipment. (See this issue.)

India.—Punjab State Electricity Board, Simla. 14th July. Substation equipment for Dadri and Bhiwani substations. (E.S.B. 10518/59. Ten/38858.)* 15th July. Hydro-electric plant of 25, 40 and 100 kW capacity for installation in Lahaul Valley. (E.S.B. 10535/59. Ten/38859.)*

Madras State Electricity Board. 8th June. Switchgear for Tudiyalur and Madurai substations. (E.S.B. 10522/59. Ten/38848.)*

Iran.—Ministry of Posts and Telegraphs, Teheran. 6th June. Transmission measuring equipment for lines and for carrier frequency systems. (E.S.B. 10388/59. Ten/38871.)*

Iraq.—Directorate General of Municipalities, Baghdad. 23rd May. Switchboard with accessories for Tuz Water and Electricity Board. (E.S.B. 9411/59. Ten/38908.)*

Korea.—Government Office of Supply, Seoul. 29th May. Telecommunication components. (E.S.B. 11165/59/I.C.A. Ten/38946.)*

Middlesbrough.—Corporation. 25th May. Electric lamps (Form No. 23), for the year ending 30th June, 1960. Borough engineer, Municipal Buildings.

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

Newhaven.—U.D.C. 1st June. Street lighting equipment. (See this issue.)

New Zealand.—New Zealand Electricity Department, Wellington. 14th July. One 50,000 kVA, 110/33/11 kV transformer bank. (E.S.B. 10849/59. Ten/38920.)*

Pakistan.—Director General, Department of Supply and Development, Karachi. 25th May. 150 45 kVA pole mounted, oil immersed transformers. (E.S.B. 10782/59/I.C.A. Ten/38880.)*

Romford.—Corporation. 25th May. Electrical installations in 28 maisonnettes. (See this issue.)

South Africa.—Stores Department, South African Railways, Johannesburg. 29th May. Communication cable. (E.S.B. 10851/59. Ten/38888.)* One 400 V and two 11,750 V switchboards and three 400 kVA transformers. (E.S.B. 10853/59. Ten/38899.)*

Union Tender Board, Pretoria. 3rd June. Radio test equipment. (E.S.B. 10925/59. Ten/38903.)*

Thailand.—Thailand Tobacco Monopoly, Bangkok. 19th May. Underground cables. (E.S.B. 10899/59. Ten/38919.)*

ORDERS PLACED

Hebburn-on-Tyne. — U.D.C. Electrical installations in 69 dwellings in Finchale Road, Hebburn (£2,004).—N. Robinson & Co.

Newcastle-on-Tyne.—City Council. 1,200 post-top lanterns for street lamps (£6,225).—Engineering & Lighting Equipment Co.

Scunthorpe.—Corporation. Recommended. Electrical installation works in 208 dwellings at the Church Farm and Riddings estates (£5,323).—Hobson & Scott.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Alcester.—Houses (30), The Leys, Bidford; F. B. Andrews & Son, architects to R.D.C., 95, Colmore Row, Birmingham.

Ascot.—Extensions, Heatherwood Hospital (£122,150); J. R. Harris, architect, 38, Queen Anne Street, London, W.1.

Axminster.—Houses (42), Millwey Rise estate; F. S. Kett, architect, Axminster, Devon.

Aylesbury.—Church, Coventon Road, Quarrendon; R. C. White, architect, Temple Square.

Houses (200), Coventon Road estate; Drabble Construction Co., Ltd., Vicarage Road, Bletchley.

Junior school, Tring Road (£50,000); F. Pooley, county architect, County Offices, Aylesbury.

Bexhill.—Offices and flats, Wilton Road; Kenneth G. Higgs, architect, 7, Wilton Road.

Billingham-on-Tees.—R.C. church, Central Avenue; Hudson Brothers, builders, Fidler Street, Middlesbrough.

Birmingham.—Factory, Mott Street; Smith & Wright, Ltd., 180, Brearley Street.

Wychbold Technical School (£220,000); Frank Davis, Ltd., College Road.

Extensions, Tyburn Road Omnibus Works (£170,000); Tersons, Ltd., 4, Dollis Park, London, N.3.

Bletchley.—Out-patients' clinic; W. J. Jobson, architect, 43, Banbury Road, Oxford.

Boldon.—Bungalows (18), South Bents, Whitburn; J. Prentice, builder, Leeds Street, Sunderland.

Brighton.—Children's homes at Hollingdean, Lower Bevendean and South Woodingdean; D. J. Howe, borough surveyor, 26/30, King's Road.

Bristol.—Seven-storey building, Rupert Street/Lewins Mead site; William Cowlin & Son, Ltd., builders and estate agents, Stratton Street, Bristol, 2.

Buxton.—Science laboratory, preparation rooms, etc., at Buxton College, College Road; county architect, St. Mary's Gate, Derby.

Canvey Island.—Fire station; Gerald Shenstone & Partners, architects, 34, Bloomsbury Way, London, W.C.1.

Cardiff.—Showroom and office block (£300,000), Wood Street; Tersons, Ltd., 4, Dollis Park, London, N.3.

Cheltenham.—Extensions, St. Mary's College (£250,000); Hening & Chitty, architects, 20, Percy Street, London, W.1.

Chertsey.—Five-class school (£40,806) and junior mixed school and infants' school (£97,993); J. Harrison, county architect, County Hall, Kingston-on-Thames.

Chester-le-Street.—Factory extension (fifth stage); Caterpillar Tractor Co., Ltd., Birtley.

Proposed motel with filling station, restaurant, etc., at Birtley for C.M.Y. Property Co.; Matkin & Hawkins, Bank Chambers, Fawcett Street, Sunderland.

Dartford.—Housing estate, Joydens Wood; T. Walsh, builder, 67, Towneley Road, Bexleyheath.

Showrooms and offices, High Street; Oliver E. Steer, architect, 19, Hatherley Road, Sidcup.

Denbighshire.—Police houses (26); R. McFarlane, county architect, Grove Park, Wrexham.

Dunfermline.—Flats (100), Aberdour Road; burgh architect, 6, Abbot Street, Dunfermline, Fife.

Durham.—Additions to Durham Girls' Grammar School (£140,000); county architect, South Street, Durham.

Edinburgh.—Erection of St. Crispin's Special School, West Mains (£52,570) and Napier Technical College (about £1,000,000); A. Steele, city architect, City Chambers, High Street.

Hampshire.—Fire stations at Twyford and Totton; county architect, The Castle, Winchester.

Louth.—Houses (20), High Holme Road; Taylor & Coulbeck, Ltd., Cleethorpes.

Lutterworth.—Houses (26), Dunton Bassett, Arnesby and Walton; R.D.C. surveyor, Lutterworth, Leics.

Mansfield.—Extensions; Landers Bread, Ltd., Oxford Street.

Middlesbrough.—R.C. church, Westbourne Grove; Keelan, Ltd., builders, King Street, Thornaby.

Milford Haven.—Nine-storey hotel, Hubberston Fort; Gunton & Gunton, architects, Empire House, St. Martin's-le-Grand, London, E.C.1.

Northallerton.—Houses (20), Forest Road; Brierley, Leckenby & Keighley, architects, 10, Lebdal, York.

Norwich.—Factory for Roneo, Ltd., Romford, Essex; A. E. Symes, Ltd., Albert Works, Brentwood.

Oxford.—Extensions at Cutteslowe County Primary School (£30,850), and Bayswater School (£27,300); city architect, Town Hall.

Redcar.—Houses (158), Lakes estate; K. W. Ash, borough engineer.

Wantage.—Grammar school; Benfield & Loxley, Ltd., builders, 106, Bullingdon Road, Oxford.

Watford.—Works extensions; Sun Printers, Ltd., Whippendell Road.